STAR

Scientific and Technical Aerospace Reports

SEMIMONTHLY ABSTRACT JOURNAL

JULY 23, 1969

VOLUME 7 • NUMBER 14

N69-26151—N69-27600

DOCUMENTS DEPT.

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UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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Scientific and Technical Aerospace Reports, Volume 7, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by the Technical Information Services Company.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

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02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2440**

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Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **2444**

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Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **2460**

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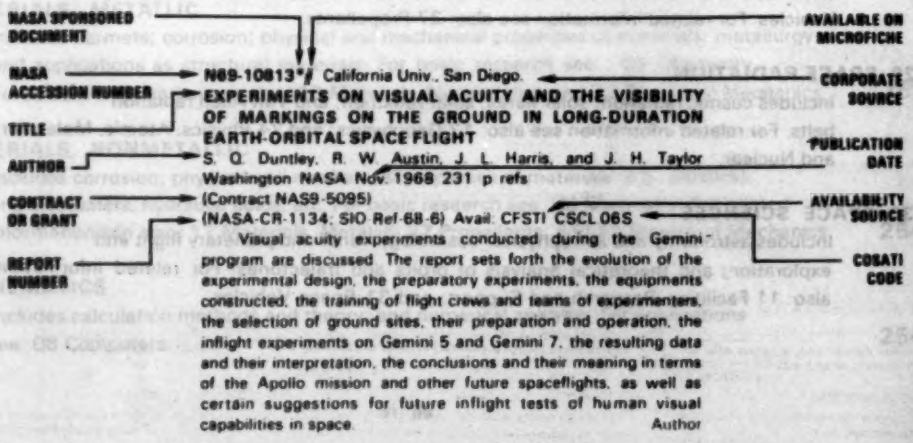
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N69-10813*# California Univ., San Diego.
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PUBLICATION DATE
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
Washington NASA Nov. 1968 231 p refs
CONTRACT OR GRANT
(Contract NAS9-5095)
AVAILABILITY SOURCE
REPORT NUMBER
(NASA-CR-1134; SIO Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

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N69-26157# Advisory Group for Aerospace Research and Development, Paris (France).

A LITERATURE SURVEY ON THE AERODYNAMICS OF AIR CUSHION VEHICLES

A. Harting (Natl. Aerospace Lab., Amsterdam) 1969 248 p refs (AGARD-565) Avail: CFSTI

A survey is presented of current knowledge concerning the aerodynamic aspects of various principles which can be applied to create and retain a cushion of pressurized air between the ACV-bottom and the supporting surface. It is primarily the result of a study of a large amount of open literature, although some original thought on the hovering flight of annular jet ACVs have been included. A definition of the ACV is proposed, followed by a short list of significant historical data. A classification of the air cushion sealing systems into seven basic principles is discussed. Discussions are presented on a large number of theoretical and experimental investigations concerning the application of the seven sealing principles. Major attention has been paid to the annular jet principle. Author

N69-26159# Weapons Research Establishment, Salisbury (Australia).

A METHOD FOR REMOVING NUMERICAL INSTABILITY FROM THE SOLUTION OF THE INVERSE THICK-SHELL HEATING PROBLEM

I. C. Heron Dec. 1968 45 p refs (TN-HSA-139) Avail: CFSTI

Some of the problems that arise in calculating outer body temperatures from temperatures measured at the inside surface of a research vehicle, the so-called inverse problem, are identified. It is shown that numerical instability occurs in the conventional solutions of this problem, for both slabs and hemispherical shells, when the walls are too thick, and a powerful method for eliminating this difficulty is presented. A detailed description is given of a FORTRAN 2 computer program applying the method to hemispherical shells of uniform thickness. It is noted that the technique may have applications to other problems whose solutions involve integral transforms. Author

N69-26271*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HYPERSONIC FLUTTER ANALYSIS USING MEASURED STATIC AERODYNAMIC DERIVATIVES, AND COMPARISON WITH EXPERIMENT

Robert C. Goetz Washington May 1969 52 p refs (NASA-TN-D-5233) Avail: CFSTI CSCL 01A

A two-part investigation was conducted, the final intent being to evaluate a quasi-steady flutter analysis technique, using measured static aerodynamic derivatives, at hypersonic speeds. In the first part, static force and moment data were obtained for a series of square-planform double-wedge airfoils with both sharp and circularly blunted leading edges. Aerodynamic characteristics were obtained in helium flow over an angle-of-attack range of $-2°$ to $8°$ at Mach numbers of 6.8 and 15.3. The results indicate that increasing the leading-edge bluntness greatly increases the drag and decreases the lift at a given angle of attack at both Mach numbers. At a Mach number of 6.8 the aerodynamic center was found to shift forward with increase in bluntness, while at a Mach number of 15.3 there was a slight rearward shift. In the second part of the investigation, a two-degree-of-freedom quasi-steady flutter analysis, including rate terms, is formulated for these airfoils in terms of the experimentally determined slope of the lift curve and location of the aerodynamic center. These comparisons indicate that the pitch-rate term has a significant effect upon the flutter solution and should be included in the quasi-steady analysis. Author

N69-26312*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL DATA FOR TWO 1400-FEET PER SECOND TIP SPEED COMPRESSOR ROTORS OPERATED WITH INLET FLOW DISTORTIONS

Everett E. Bailey and Robert S. Ruggeri Washington May 1969 74 p refs Avail: CFSTI CSCL 01A

Data for two 1400-feet-per-second tip speed rotors operated with radial and circumferential flow distortions are presented for a range of equivalent rotor speeds from 50 to 100 percent. Rotor design pressure ratios were 1.6 and 1.76. Data are presented mostly in tabular form, and include radial and circumferential distributions of inlet and discharge total pressures and temperatures, and various wall static pressure measurements along the hub and outer casing. Uniform inlet flow data are included for comparison. Observations of flow conditions at near-stall, with and without distortion, are made. The desirability of comparing distortion data at zero stall margin is discussed. Author

N69-26328* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF A RECTANGULAR SIMULATED WING ON THE PRESSURE-DRAG COEFFICIENT OF VARIOUS BOAT TAILS AT MACH NUMBERS FROM 0.60 TO 1.47

Douglas E. Harrington 1969 61 p refs
(NASA-TM-X-52609) Avail: CFSTI CSCL 01A

The investigation was conducted in the 8- by 6-foot supersonic wind tunnel with two 15° conical boattails, a 20° conical boattail, and a 25° conical boattail. The 15° boattails had radii of curvature of 0 and 0.5 nacelle diameters at the juncture with the cylindrical nacelle. The base-to-nacelle-diameter ratio was 0.67 and the jet was simulated by a solid cylinder which had a diameter equal to the afterbody-base diameter. When compared with isolated boattail data, the presence of the rectangular wing reduced the axial-force coefficient over the entire range of variables tested. At subsonic and transonic speeds, the rectangular wing did not effectively simulate a complete airplane installation. However, at supersonic speeds, agreement with complete airplane installation data was fairly good, particularly for the 15° boattail with a juncture curvature of 0 nacelle diameters. The effect of increasing boattail angle on pressure drag is influenced by the separation characteristics of these high-angle conical boattails. Author

N69-26370# Aeronautical Research Council (Gt. Brit.)
A CONVERGENT NOZZLE FOR THE STANDARDISATION OF THRUST-RIG MEASUREMENTS
M. V. Herbert 1969 24 p refs Supersedes NGTE-R-293; ARC-29991; see N68-24947
(ARC-R/M-3586; NGTE-R-293; ARC-29991) Copyright. Avail: CFSTI; HMSO 10s 6d

It is shown that an increase of Mach number from approximately 0.2 to 0.4 at entry to a convergent nozzle of specified shape does not appreciably change its performance. Such a nozzle is thus recommended as a standard device for calibrating the air meter on any thrust rig. For more general application as a means of mass-flow measurement, a value of discharge coefficient can be taken from this work, provided the flow conditions at entry are reasonably uniform, and excluding high temperatures. Use of that value may be subject to certain corrections, and its absolute accuracy when applied to any nozzle of the same nominal specification may not be better than ±0.3 per cent. Author (ESRO)

N69-26373# National Physical Lab., Teddington (England). Aerodynamics Div.
MEASUREMENTS OF THE OSCILLATORY PITCHING-MOMENT DERIVATIVES ON A SLENDER SHARP-EDGED DELTA IN INCOMPRESSIBLE FLOW
L. Woodgate 2 Jul. 1968 20 p refs
(NPL-Aero-1274; ARC-30357) Copyright. Avail: CFSTI

Oscillatory pitching-moment derivatives, m_q and $m_{\dot{\alpha}}$, have been measured by an inexorable forcing method on a delta wing of aspect ratio 0.654 in pitching motion. Mean incidence has been varied from 0° to 15°, frequency parameter from 0.2 to 1.0, and Reynolds number from 1.28×10^6 to 2.30×10^6. The derivatives showed large and approximately linear variations with incidence. Comparisons are made with previous measurements on a delta wing of higher aspect ratio also with sharp edges. In general the numerical values of the derivatives and the variation in the derivatives due to changes in, the mean incidence, frequency of oscillation and Reynolds number are smaller for the more slender wing. Author (ESRO)

N69-26391# Aeronautical Research Council (Gt. Brit.)
AN EXPERIMENTAL INVESTIGATION OF WALL-INTERFERENCE EFFECTS ON DYNAMIC MEASUREMENTS ON HALF-MODELS IN VENTILATED TUNNELS THROUGH THE TRANSONIC SPEED RANGE
A. W. Moore and K. C. Wight 1969 53 p refs Supersedes NPL-Aero-1243; ARC-29331; see N68-21903
(ARC-R/M-3570; NPL-Aero-1243; ARC-29331) Copyright. Avail: CFSTI; HMSO £1 3s

An experimental investigation using four ventilated tunnels shows that wall interference on dynamic measurements grows with subsonic Mach number and usually persists to low supersonic speeds. The supersonic interference is associated with an upstream propagation of disturbances in the plenum chamber. Tests in a perforated tunnel show interference effects in subsonic flow comparable with those for a slotted tunnel and equally serious effects at least up to $M = 1.35$. Variation of diffuser suction to the plenum chambers behind the perforated walls was found to change the damping derivatives significantly. Author (ESRO)

N69-26393# Aeronautical Research Council (Gt. Brit.)
AN APPLICATION OF FLAX'S VARIATIONAL PRINCIPLE TO LIFTING-SURFACE THEORY
D. E. Davies 1969 40 p refs Supersedes RAE-TR-67103; ARC-29600
(ARC-R/M-3564; RAE-TR-67103; ARC-29600) Copyright. Avail: CFSTI; HMSO 17s 6d

The loading on a harmonically oscillating wing is represented by a linear combination of given functions which satisfy the edge conditions. The coefficients in this linear combination are determined by an application of the variational principle due to Flax, so that the required generalised airforces acting on the wing are obtained to the greatest accuracy possible. For the particular case of subsonic flow, it is shown that, when certain numerical integration techniques are used, the results reduce to those obtained from a normal collocation procedure for lifting-surface theory. The procedure using the variational principle is shown to be superior to one which obtains the coefficients in the loading expression by minimising the integral of the square of the difference between the actual and calculated upwashes on the wing surface. Illustrative examples in two-dimensional incompressible oscillatory flow are given. Author (ESRO)

N69-26430# RAND Corp., Santa Monica, Calif.
NEARLY NORMAL EXPANSION FOR FORCED AND INHOMOGENEOUS TURBULENCE
W. C. Meecham and D.-T. Jeng Jan. 1969 30 p refs
(Contract F44620-67-C-0045)
(AD-683254; RM-5800-PR) Avail: CFSTI CSCL 20/4

Earlier work with the nearly-normal expansion is extended to include forced, statistically stationary turbulence. The nature of the time-transformation of the Cameron-Martin-Wiener representation is discussed. For a stationary process one obtains much information using the representation at one time. A spectrum is found for real turbulence and shown to be related to turbulence intermittency. Using a hypothesis for the (small) non-Gaussian part of the velocity -- a hypothesis suggested by earlier work -- a corrected mixing-length theory is found with an eddy viscosity. Author (TAB)

N69-26451# National Physical Lab., Teddington (England). Aerodynamics Div.
MEASUREMENTS OF THE OSCILLATORY PITCHING-MOMENT DERIVATIVES ON A SHARP-EDGED DELTA WING AT ANGLES OF INCIDENCE FOR WHICH VORTEX BREAKDOWN OCCURS
L. Woodgate 2 Jul. 1968 27 p refs
(NPL-Aero-1275; ARC-30358) Copyright. Avail: CFSTI

Pitching-moment derivatives have been measured on a sharp-edged delta wing of aspect ratio 1.484 for a range of incidence from $\alpha = 20°$ to 35°. For $\alpha = 30°$ and 35°, vortex breakdown occurred above the wing surface. Some numerically-low

values of both the stiffness and damping derivatives were obtained for $\alpha = 30°$ at low frequency parameters and these are attributed to vortex breakdown. Corresponding measurements at higher frequency parameters were practically unaffected. Flow visualisation showed that the pitching oscillation led to an oscillation of the streamwise position of the vortex breakdown but, for the small amplitude of oscillation used, had no effect on the mean position of the breakdown. Author (ESRO)

N69-26477# National Physical Lab., Teddington (England). Hovercraft Unit.

THE EFFICIENCY LOSS OF A PROPELLER DUE TO SLIPSTREAM ROTATION

J. R. Bishop Jan. 1968 21 p

(NPL-Hovercraft-1) Copyright. Avail: CFSTI

This report derives a simple theory for the efficiency loss of a propeller due to the rotational or whirl velocity imparted to the slipstream. A discussion of various aspects is presented as the theory develops. The work was carried out for two reasons: (1) To provide a simple understanding of the efficiency loss of an air propeller working at low tip speed. This loss had been highlighted by work on quiet air propellers for hovercraft. Reduction of the design tip speed is probably the most powerful method of reducing propeller noise. (2) Work on axial flow fans was being carried out by the N.P.L. Hovercraft Unit and it was apparent that propeller and fan theories appear very dissimilar, when in fact the actual flow processes with these devices are similar in many ways. It was felt advisable, therefore, to try and relate some aspects of propeller theory to those of fan theory. Theory shows that slipstream rotation loss depends only on the propeller velocity diagram and can be deduced from a knowledge of the propeller disc loading and blade speed. It does not depend on the type of lifting surface which is used. It is also shown that the slipstream rotation efficiency term is the same as the degree of reaction of an axial flow fan or compressor. The theory assumes zero blade drag, but it is not expected that the accuracy will be altered very much by inclusion of the blade drag, i.e. it is assumed permissible to separate the blade drag and slipstream rotation efficiency Author (ESRO)

N69-26478# National Physical Lab., Teddington (England). Hovercraft Unit.

ESTIMATION OF HEAD-FLOW CURVES FOR CENTRIFUGAL FANS

J. C. Shipway Oct. 1968 31 p refs

(NPL-Hovercraft-5) Copyright. Avail: CFSTI

A project method is presented, in non-dimensional form, for the prediction of the head-flow characteristics of a centrifugal fan at constant speed. The predicted characteristics show fair agreement with experimental characteristics of fans with backward and forward facing blades and with aerofoil or sheet metal blades. The method constitutes a useful tool in the design of centrifugal fans for a given application. Author (ESRO)

N69-26479# National Physical Lab., Teddington (England). Hovercraft Unit.

AERODYNAMIC DESIGN OF AXIAL LIFT FANS

J. C. Shipway Jul. 1968 26 p refs

(NPL-Hovercraft-4) Copyright. Avail: CFSTI

A method is given for the design of axial flow lift fans of low solidity. Fan design data and the corresponding head/flow characteristics are derived from values of design head and flow, overall dimensions and R.P.M. The method has been successfully applied to the design of HD2 lift fans, for unstalled conditions. Author (ESRO)

N69-26484# National Physical Lab., Teddington (England). Aerodynamics Div.

WIND-EXCITED OSCILLATIONS OF GROUPS OF FOUR RODS OF CIRCULAR CROSS-SECTION

D. E. Walshe Sep. 1968 9 p refs

(NPL-Aero-Note-1072) Copyright. Avail: CFSTI

A short series of tests were carried out on a sectional model to investigate the wind-excited oscillations of the cables of a cable-stayed bridge; the cables were made up of four wire ropes clamped together. The tests, though not exhaustive, indicated that the rope configuration was such that galloping oscillations could be induced. It was shown that other rope configurations were also unstable in wind but that stability could be promoted by spacing the ropes. The stabilizing effect of a perforated shroud surrounding the model cable was confirmed. Author (ESRO)

N69-26485# National Physical Lab., Teddington (England). Aerodynamics Div.

RECENT NPL RESEARCH ON SUPERSONIC AERODYNAMICS

P. G. Pugh, M. J. Larcombe, and L. C. Ward 5 Apr. 1968 24 p refs

(NPL-Aero-Note-1074) Copyright. Avail: CFSTI

This paper describes recent detailed studies of supersonic flow fields conducted at NPL. Three major topics are discussed: (1) the minimisation of forebody drag; (2) the lift and stability of delta wings and conical bodies; (3) boundary layer transition. Author (ESRO)

N69-26486# National Physical Lab., Teddington (England). Aerodynamics Div.

AERODYNAMIC STABILITY TESTS OF VARIOUS SHELL CONFIGURATIONS OF A MULTI-FLUE STACK MODEL

D. E. Walshe Sep. 1968 23 p refs

(NPL-Aero-SR-013) Copyright. Avail: CFSTI

Aerodynamic stability tests were carried out on five chimney stack models to compare their response to vortex excitation. Because of practical considerations, the tests were limited to a comparison of the response at sub-critical Reynolds numbers and in smooth winds. The basic model was a cylinder of circular cross-section representing the outer shell of a stack of H/D = 9.92 with three internal flues. The shell was modified to form the other four models. It was found that aerodynamic stability could be achieved by either exposing the flues over the top part of the model or by perforating the top part of the shell with equispaced square holes with sides of 0.07D. The model perforated in the upper 0.29H of the shell by vertical slots was found to remain aerodynamically unstable. Author (ESRO)

N69-26524*# Wyle Labs., Inc., Huntsville, Ala. Research Staff.

MACROSCALE TURBULENCE NEAR THE POTENTIAL CORE OF A SUBSONIC JET

E. B. Miller May 1968 125 p refs

(Contract NAS8-21060)

(NASA-CR-101106; WR-68-11) Avail: CFSTI CSCL 01A

Large scale turbulence was investigated beside the potential core of a 4-inch Mach 0.1 cold air jet. The outputs from an array of eight hot-film anemometers were rapidly multiplexed and stored digitally on tape so that phase relationships were essentially preserved. These data and a modified Taylor hypothesis were then used to provide plots of velocity and vorticity as functions of time in the turbulent shear region at x/d = 3. The sensor array was located at a position near the potential core and near the outer jet boundary. Photographs from a qualitative visualization study were used, together with the anemometer data, in formulating a model for the flow processes in this region. Conclusions resulting from

the use of hot-film sensors in this program and from a literature search for information concerning the overall accuracy of the hot-wire anemometer are also presented. Author

N69-26582# Lockheed Missiles and Space Co., Palo Alto, Calif.
QUANTITATIVE INVESTIGATIONS OF SHOCKWAVE PROCESSES BEHIND A SHOCK
V. A. Emel'ianov et al 1969 4 p refs Transl. into ENGLISH from Prikl. Mekh. Tekhn. Fiz. (Moscow), no. 1, 1969 p 101–104
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method for investigating the inhomogeneities bounded by a shock is described. The system permits computation of the density in gas flows with a shock, when the number of zones into which the section of inhomogeneity is determined. Using a standard IAB-451 shadowgraph, results are presented of an investigation of low density flows behind the section of a shock tube. F.O.S.

N69-26573*# General Electric Co., Lynn, Mass. Aircraft Engine Technical Div.
EXPERIMENTAL EVALUATION OF OUTER CASE BLOWING OR BLEEDING OF SINGLE STAGE AXIAL FLOW COMPRESSOR PART 5: PERFORMANCE OF PLAIN CASING INSERT CONFIGURATION WITH DISTORTED INLET FLOW
C. C. Koch May 1969 52 p refs
(Contract NAS3-7618)
(NASA-CR-54591; GE-R69AEG103) Avail: CFSTI CSCL 01C

An isolated transonic rotor having an aspect ratio of 4.5 was tested under several conditions of distorted inlet flow. Overall and stalling performance was determined for each inlet condition, and extensive surveys of flow conditions were made for one case of circumferential inlet distortions. Although this rotor stalls at the pitchline with undistorted inlet flow, the tip of the rotor is limiting when inlet flow distortions exist. The effect of intense circumferential inlet distortions was to reduce stalling weight flow by such a large extent that stall margin increased despite a reduction in stalling total-pressure ratio. The same effect was observed with less intense circumferential inlet distortions at the lower speeds, but at design speed there was less of a reduction in flow and a slight loss in stall margin. One radial inlet distortion condition was tested, and produced a substantial loss in stall margin. Author

N69-26581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INVESTIGATION OF THE AERODYNAMICS OF A TWISTED JET PROPAGATED ALONG A CYLINDRICAL WALL IN A CO-STREAM
I. I. Ibragimov and B. P. Ustimenko 27 Sep. 1968 15 p refs Transl. into ENGLISH from Probl. Teploenerg. Prikl. Teplofiz. (USSR), no. 2, 1965 p 166–172
(AD-683108; FTD-HT-23-565-68) Avail: CFSTI CSCL 20/4

The flow of air, which is twisted by a bladed apparatus, issues from an annular slit (thickness 2.5 mm) and is propagated along a rod (diameter 45 mm). The velocity and static pressure are measured by a three-channel probe. The profiles of the tangential and axial velocities and the static pressure are recorded. The self-similar nature of the velocity profile, and the static pressure in the case of different ratios of the initial velocity of the costream to the initial axial velocity of the jet and of the maximum tangential velocity on egress from the nozzle to the initial axial velocity of the jet are established. The similarity of the profiles of the axial and tangential components of velocity, and the effect of the twist of the jet on damping of the latter are discussed. Author (TAB)

N69-26829# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
A PREDICTIVE METHOD FOR THE BENDING AND MIXING OF A SUPERSONIC TURBULENT JET AT A SMALL ANGLE TO A SUPERSONIC STREAM
A. Goldburg, E. M. Murman, R. P. Shreeve, and I. J. Wygnanski Oct. 1968 31 p refs
(AD-683569; D1-82-0777) Avail: Issuing Activity CSCL 1/3

Three separate methods were investigated for use in predicting the centerline trajectory of the deflecting jet. They are: (1) Theory of Ehlers and Strand; (2) Empirical correlations; (3) Momentum balance models. Author (TAB)

N69-26869 Rochester Univ., N.Y.
AN AERODYNAMIC APPROXIMATION FOR UNSTEADY SUPERSONIC FLOW THROUGH A DUCT OF REVOLUTION
Richard Allen Skop (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-15861

A finite flexible duct of revolution, moving parallel to its axis of revolution at supersonic speeds into a perfect gas, is considered. It is assumed that the inlet conditions are well-known and supersonic, and that the outlet conditions are such that the flow remains supersonic everywhere within the duct. It is further assumed that the flow is inviscid and compressible, and that the inlet flow is uniform and irrotational. The internal theories are used to obtain both steady and unsteady cross-sectional averages of the coefficient of pressure, and a comparison is made with the results predicted by one-dimensional steady flow theory. The well-known limitations of one-dimensional steady flow are readily deduced from this comparison. Dissert. Abstr.

N69-26895# National Physical Lab., Teddington (England). Aerodynamics Div.
THE INTERACTION BETWEEN LOCAL EFFECTS AT THE SHOCK AND REAR SEPARATION: A SOURCE OF SIGNIFICANT SCALE EFFECTS IN WIND-TUNNEL TESTS ON AEROFOILS AND WINGS
H. H. Pearcey, J. Osborne, and A. B. Haines (Aircraft Res. Assoc. Ltd.) 15 Jan. 1969 96 p refs Presented at the AGARD Specialists' Meeting on Transonic Aerodyn., Paris, 18–20 Sep. 1968 Revised
(NPL-Aero-1071; ARC-30477) Copyright. Avail: CFSTI

Attention is drawn to important restrictions to the range of applicability of the flow model developed in earlier work on shock-induced separation of turbulent boundary-layers on aerofoils and wings, and also corresponding restrictions to the conclusion then drawn that full-scale behaviour could readily be reproduced at low Reynolds numbers. These restrictions arise because the model of a bubble growing progressively from the foot of the shock towards the trailing edge does not include the interaction that sometimes occurs between the disturbance at the foot of the shock and a subsonic-type rear separation if one exists, or is incipient in the continuous adverse gradient further downstream. Such interactions are shown to be of increasing importance at wind-tunnel scale (as the possibilities of using thicker and more highly loaded wing sections develop) and to introduce real difficulties in reproducing full-scale behaviour at low or moderate Reynolds numbers. Author (ESRO)

N69-26976*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JET EFFECTS ON BOATTAIL PRESSURE DRAG OF ISOLATED EJECTOR NOZZLES AT MACH NUMBERS FROM 0.60 TO 1.47

Douglas E. Harrington Washington May 1969 88 p refs
(NASA-TM-X-1785) Avail: CFSTI CSCL 20D

The cylindrical ejector nozzles were operated over a range of pressure ratios from approximately 1.0 (jet off) to 11. Results were obtained with both 15° and 10° boattail angles. The 15° configurations utilized different radii of curvature at the boattail juncture with a cylindrical forebody. Subsonically, the jet caused large reductions in boattail pressure drag whether the jet was under or overexpanded. A jet boundary simulator was effective in duplicating a fully expanded jet with an exit static-pressure ratio of one.
Author

N69-27005# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.

ROTOR INDUCED FLOW FIELDS IN GROUND EFFECT IN THE VICINITY OF A VERTICAL STEP Scientific Report, Jul.–Dec. 1968

Paul G. Migliore Jan. 1969 85 p refs
(Contract N00014-68-A-0512)
(AD-683792; TR-12) Avail: CFSTI CSCL 1/3

It is the purpose of this analysis to devise a means of theoretically predicting the flow fields induced by hovering rotors in ground effect and influenced by the proximity of a vertical step. A two dimensional investigation is performed. Assuming a perfect fluid allows the problem to be solved using complex potential theory. Values of induced velocities and stream function are determined by considering the contributions of a finite number of discreet vortices and their images in the transformed plane. Results appear to be qualitatively accurate within the confines of the wake cylinder and in areas very close to the wake boundaries. Author (TAB)

N69-27041# Advisory Group for Aerospace Research and Development, Paris (France).

RECORD OF AGARD LECTURE SERIES 24 TO 28, SUPPLEMENT 1

V. G. Vannucci, comp. and J. C. Dunne, comp. 1968 53 p
(AGARD-LS-24-28-Suppl-1) Avail: CFSTI

In 1966, the AGARD Technical Information Panel sponsored the preparation of a record of all the AGARD Lecture Series held in the years 1954 to 1966. The record, issued later that year, covered Lecture Series 1 to 23. It has been decided that the record should be kept up-to-date by the periodic publication of Supplements. This first Supplement covers Lecture Series 24 to 28, all of which were held in 1967. The Supplement comprises a bibliography of extended summaries of the individual lectures. An author index is included.
Author

N69-27050# National Physical Lab., Teddington (England). Aerodynamics Div.

THE AERODYNAMIC INVESTIGATION FOR A BOX-TYPE ROADWAY DECK FOR A SUSPENSION BRIDGE PROPOSED FOR THE NUMBER CROSSING

D. E. Walshe Aug. 1968 20 p refs
(NPL-Aero-SR-012) Copyright. Avail: CFSTI

Tests were made to determine the aerodynamic stability characteristics of the roadway deck of the proposed bridge. The results indicate that the structure is subject to limited amplitude oscillations in single-degree-of-freedom modes and to coupled vertical bending and torsional oscillations at high wind speeds. The coupled motion was shown to be a classical flutter instability. The oscillations in single-degree-of-freedom modes did not require high values of structural damping for their suppression.
Author (ESRO)

N69-27083# Aircraft Research Association, Ltd., Bedford (England).

THE DETERMINATION OF THE BUFFET BOUNDARIES OF AEROFOILS IN THE TRANSONIC REGIME

Fred Thomas Feb. 1969 64 p refs Transl. into ENGLISH of Jahr. 1966 Wiss. Ges. Luftfahrt (Berlin)
(ARA-Lib-Trans-19) Avail: CFSTI

At flight speeds near the speed of sound shock waves occur on airfoils and the strong increase of pressure through the shock waves causes a separation of the boundary layer, which in turn provokes the buffeting of the airfoil. Flight speeds beyond the buffet boundary must be avoided in order to prevent stability problems and excessive loads. Besides wind-tunnel tests, the only way of defining the buffet boundary consists of empirical criteria. Comparisons have shown that the results obtained from these criteria are not satisfactory in all cases. It is desirable to supplement these criteria by more advanced theoretical methods. A completely new approach to the solution of the problem was made by the application of boundary layer theory. First of all the transonic pressure distribution including the shock wave is calculated, and then the separation points are calculated as a function of the Mach number by means of the boundary layer theory. From these separation boundaries, immediate conclusions may be drawn concerning the appearance of buffeting.
Author

N69-27107# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BODIES OF REVOLUTION WITH A MINIMUM DRAG FACTOR AND LOW HEAT TRANSFER AT HIGH SUPERSONIC FLIGHT SPEEDS

G. L. Grodzovskii 18 Nov. 1968 27 p refs Transl. into ENGLISH from Russian Presented at the 19th Congr. of the Intern. Astron. Federation, New York, 1968
(AD-684022; FTD-HT-23-1102-68) Avail: CFSTI CSCL 20/4

On the basis of the modified Newton theory and the theory of self-similar hypersonic flows, an investigation was made of the optimum shape of a body of revolution with a minimum drag factor at supersonic speeds. It is shown that optimum bodies also have a low heat-transfer coefficient – considerably less than for a conical body. It was established experimentally, that the optimum properties of the examined bodies of revolution are preserved even at moderate supersonic flight speeds.
Author (TAB)

N69-27200# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AEROMECHANICS OF AIRCRAFT (SELECTED PARTS OF SELECTED CHAPTERS)

V. B. Baidakov et al 14 Feb. 1968 51 p refs Transl. into ENGLISH from the book "Aeromekhanika Letatelnykh Apparatov" Moscow, Izd-Vo Mashinost., 1965 p 70–72; 84–101; 166–171; and 406–407
(AD-683175; FTD-MT-24-250-67) Avail: CFSTI CSCL 20/4

The book outlines fundamentals of aeromechanics, the structure and physical properties of the atmosphere, aerodynamic characteristics of wings, and modern methods of aerodynamic investigations. Chapters deal with the stability and controllability of flying vehicles (airplanes and rockets), and with methods of their aerodynamic and ballistic design. The book is intended as a textbook for students in technical aviation schools. It may be useful to medium-level technical personnel of aviation industry.
Author (TAB)

N69-27227# France. Ministere de l'Air, Paris.

DISTRIBUTION FUNCTIONS OF TURBULENT SPEEDS IN A BOUNDARY LAYER: EFFECTS OF THE RESPONSE OF A HOT WIRE ANEMOMETER [FONCTIONS DE REPARTITION

DES VITESSES TURBULENTES DANS UNE COUCHE LIMITE: EFFETS DE LA REPONSE DE L'ANEMOMETRE A FIL CHAUD]
Jacques Marcillat 1969 83 p refs *In* FRENCH
(Rept-443) Avail: Issuing Activity

An experimental study of a turbulent boundary layer on a plane surface was carried out to characterize the structure of turbulent velocities. The distribution functions of fluctuations of velocity permitted the determination of different moments (average velocity, intensity of turbulence, moments of the order 3 and 4). The comparison of these calculated moments, with the results of classical measurements, permitted an evaluation of the error made by neglecting the effect of nonlinearity of the hot-wire anemometer. Transl. by B.P.

N69-27229# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SHAPE OF THE SEPARATION FLOW DOMAIN CAUSED BY INCIDENCE OF A THREE-DIMENSIONAL SHOCK ON A PLATE WITH TURBULENT BOUNDARY LAYER
Iu. A. Panov [1968] 7 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan. (Moscow), no. 1, 1969 p 59–65
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Three-dimensional separation flow regularities which originate because of the interaction between shocks formed ahead of obstacles upon and above a body surface and the boundary layer were investigated. The separation flow was caused by incidence of a conical shock on a flat pointed plate in a supersonic flow of Mach 3. The boundary layer before separation was turbulent. The Reynolds number computed by means of the free stream parameters and the distance to the forward separation point was $R \cong 1.37 \times 10^7$. The shock was caused by cones with 10 to 45° half-angles, fastened at a height of 40 or 50 mm above the plate at zero angle of attack, and by wedges with angles of 7 to 20°. The plate was drained along the axis of symmetry. The flow around the model was photographed using a Toepler device, and the flow near the surface was studied by the oil coating method. Local choking of the flow between the cone and the plate was observed for a low height of the cone above the plate and at angles of from 35 to 45°. The flow reorganized at this point and an additional three-dimensional shock appeared at the point of intersection of two other shocks. The external flow velocity behind this shock became subsonic. Two triple points of intersection form in the system of compression shocks above the separation flow zone. E.C.

N69-27564# National Aerospace Lab., Amsterdam (Netherlands).
AERODYNAMICS AT NLR
Jan. 1969 19 p refs
Avail: CFSTI

The achievements and activities at NLR in the field of aerodynamic research together with the available test facilities are reviewed. Special attention is given to experience obtained in the calculation of pressure distributions around wing-body configurations and in the determination of instationary airloads. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-26172*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
A NEW MODEL PERFORMANCE INDEX FOR THE ENGINEERING DESIGN OF CONTROL SYSTEMS
Herman A. Rediess (Ph.D. Thesis) 9 Dec. 1968 374 p refs
(Grant NGR-22-009-229)
(NASA-100911; TE-26) Avail: CFSTI CSCL 01C

A parameter optimization design procedure is established that starts with practical engineering specifications and uses the Model PI as a synthesis tool to obtain a satisfactory design. Although the techniques apply to linear, time invariant, deterministic control systems in general, the thesis is developed in the context of flight control systems in order to emphasize the relationship of realistic design requirements to the synthesis process. The Model PI represents a new criterion for approximating one dynamical system by another, based on a novel geometrical representation of linear autonomous systems. It is an effective performance index in designing practical systems and is more efficient to use than a comparable model-referenced integral squared error performance index. A general digital computer program for control system design using the Model PI is developed. Some developments in linear optimal control resulting from the Model PI theory are presented. The Model PI provides a means of interpreting the state vector weighting matrix in terms of a model. A simple solution of the linear optimal control synthesis procedure using one root square locus is presented. Author

N69-26179# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HELICOPTERS: CALCULATION AND DESIGN. VIBRATIONS AND DYNAMIC STABILITY
M. L. Mil, A. V. Nekrasov, A. S. Braverman, L. N. Grodko, and M. A. Leikand 9 Aug. 1968 575 p refs Transl. into ENGLISH of Vertolety Rachet i Proektir. vol. 2 Kolebaniya i Dinam. Prochmost (Moscow), 1967 p 1–424
(AD-683091; FTD-MT-24-103-68) Avail: CFSTI CSCL 1/3

This book is volume two of Helicopters: Calculation and Design. In it are discussed certain questions of the theory of vibrations and methods of calculating stresses appearing during these vibrations. Methods of calculating structural service life are given, as well as methods of calculating vibrations of the helicopter, which allow the determination of the amplitude of these vibrations and their comparison with comfort norms. The problem of combined vibrations of the rotor and fuselage is examined for the first time in Soviet literature. The theory of self-excited oscillations of a special type, called ground resonance is discussed in detail. Peculiarities of the appearance of such oscillations of the helicopter on land, during takeoff and landing and in flight. In a separate chapter there are examined special cases of the calculation of bearings operating in specific conditions of oscillatory motion. Here there is discussed the theory and method of the calculation of a new type of thrust bearing of increased load capacity and also bearings absorbing combined loads. Author (TAB)

N69-26180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMICS OF THE Tu-104 AIRPLANE
P. T. Bekhtir 8 Aug. 1968 214 p Transl. into ENGLISH of Aerodinamika Samoleta Tu-104 (Moscow), 1967 p 1–224
(AD-683123; FTD-HT-23-364-68) Avail: CFSTI CSCL 1/3

A presentation of the aerodynamics of the Tu-104 series of twin-jet passenger aircraft (including A, B, and D-suffix versions), written for pilot and engineer personnel assigned to them. The introductory Part One (3 chapters) deals in general terms with the aerodynamics of high speeds: physical properties of air, laws of motion of air, and airfoil characteristics. Part Two (12 chapters) is on the behavior of the Tu-104 aircraft itself: design and aerodynamic

characteristics, powerplant performance, and the various phases of flight under the range of conditions encountered in operation: takeoff, climb, level flight, descent, turns, and landing; balance, stability and controllability and their limits; one-engine-out operation, with failure occurring at various times during takeoff and flight; behavior of the aircraft under turbulent and icing conditions. Author (TAB)

N69-26194*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TECHNIQUE FOR CALCULATING OPTIMUM TAKEOFF AND CLIMBOUT TRAJECTORIES FOR NOISE ABATEMENT
Heinz Erzberger and Homer Q. Lee Washington May 1969 25 p refs
(NASA-TN-D-5182) Avail: CFSTI CSCL 01C

A procedure was developed for determining optimum takeoff and climbout trajectories for jet aircraft that minimize the noise produced during overflight of communities located along the ground track of the climbout path. The procedure enables one to compute optimum takeoff trajectories for noise abatement for a particular aircraft operating from a particular airport subject to prescribed operational constraints. An important part of the procedure consists in defining appropriate criteria for noisiness of a trajectory. Two criteria are proposed and are used as a basis for calculating noise optimum trajectories: (1) the perceived noise level (in PNdB) measured after a power reduction at the beginning of the noise-sensitive area, and (2) the perceived noise level, averaged along the noise-sensitive ground track of a climbout trajectory. Calculating trajectories that minimize the chosen criterion for noisiness is interpreted as an optimum control problem. The procedure was applied to the calculation of optimum trajectories for a typical, currently in-service jet transport. Author

N69-26245# Federal Aviation Administration, Washington, D.C. Office of Policy Development.
AVIATION FORECASTS FISCAL YEARS 1969–1980
Jan. 1969 45 p
(AD-683686) Avail: Issuing Activity CSCL 1/2

Contents: Highlights of fiscal year 1968; Aviation industry forecasts (Air carrier traffic, Air carrier fleet, General aviation flying and aircraft fleet, Domestic aviation fuel consumption, Civil aircraft and engine production); FAA air traffic activity forecasts (Aircraft operations at airports with FAA traffic control service, FAA en route traffic control activity, FAA flight services). TAB

N69-26264# National Physical Lab., Teddington (England). Hovercraft Unit.
LATERAL STABILITY AND CONTROL OF HOVERCRAFT
M. J. Barratt Jan. 1968 19 p
(NPL-Hovercraft-3) Copyright. Avail: CFSTI

This note derives equations of motion suitable for simulating the lateral motion of a hovercraft, using an analogue computer. Approximations are made to simplify the problem in the light of current information. Author (ESRO)

N69-26371# Aeronautical Research Council (Gt. Brit.)
THE DYNAMICS OF AIRCRAFT ROTATION AND LIFT-OFF AND ITS IMPLICATION FOR TAIL CLEARANCE REQUIREMENTS, ESPECIALLY WITH LARGE AIRCRAFT
W. J. G. Pinsker 1969 35 p refs Supersedes RAE-TR-67065; ARC-29295; see N68-13176
(ARC-R/M-3580; RAE-TR-67065; ARC-29295) Copyright. Avail: CFSTI; HMSO 15s 6d

Ground clearance requirements are considered in relation to take-off, treating lift-off as a dynamic manoeuvre. It is shown that ground clearance is defined by conditions about one to two seconds after lift-off. Simple calculations are presented which permit a rational assessment of the proper tail and wing tip clearance margins arising from the immediate post lift-off motion of an aircraft. These effects are potentially more severe for the larger aircraft and are aggravated on tailless designs by adverse elevator lift. Recommendations are made for the use of directors and autostabilisation in this context. Author (ESRO)

N69-26465# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Stuttgart (West Germany).
HELICOPTER FLIGHT MEASUREMENTS [FLUGMESSUNGEN AN HUBSCHRAUBERN]
Aug. 1968 185 p refs In GERMAN; ENGLISH summary Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers, Stuttgart, 30 May 1968
(DLR-Mitt-68-19) Avail: CFSTI

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3. MEASURING INSTRUMENTS AND FLIGHT TESTING OF BO-105 HELICOPTER H. Gloeckl (Bolkow Entwicklungen K.G.) p 51–72 (See N69-26468 14-14)

4. COMPARISON OF COMPUTED AND FLIGHT MEASUREMENTS OF THE BOELKOW JOINTLESS ROTOR SYSTEM M. Rade (Bolkow Entwicklungen K.G.) p 73–109 (See N69-26469 14-02)

5. CONTROLLABILITY MEASUREMENTS ON HELICOPTERS G. Engel (Dornier-Werke G.m.b.H.) p 111–136 refs (See N69-26470 14-02)

6. FLIGHT MECHANIC PROBLEMS OF THE UNMANNED ROTOR PLATFORM DO 32 K U. Thenhausen (Dornier-Werke G.m.b.H.) p 137–162 refs (See N69-26471 14-02)

7. MEASUREMENTS ON VERTROL H-21 HELICOPTER R. Schroeder (Deut. Forschungsanstalt fuer Luft- und Raumfahrt) p 163–187 refs (See N69-26472 14-02)

N69-26466# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany).
FLIGHT MEASUREMENTS AND THEORETICAL CALCULATIONS ON SEVERAL HELICOPTER MODELS AT DFL-STUTTGART [FLUGMESSUNGEN UND THEORETISCHE NACHRECHNUNGEN AN VERSCHIEDENEN HUBSCHRAUBERMUSTERN BEI DER DER DFL-STUTTGART]
W. Just and H. Georgi *In* WGLR Helicopter Flight Meas. Aug. 1968 p 7–32 refs In GERMAN (See N69-26465 14-02)
Avail: CFSTI

Flight tests of some helicopters are reported. The necessary instrument package is described and the results with the S-58 and Alouette II helicopters are given. Some general conclusions are drawn on the physical behaviour of helicopters. Author (ESRO)

N69-26467# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany).
MEASUREMENTS ON ALOUETTE 2 WITH STEEL AND GFK ROTOR BLADES [MESSUNGEN MIT DER ALOUETTE 2 MIT STAHL- UND GFK-ROTORBLAETTERN]
R. Jamka *In* WGLR Helicopter Flight Meas. Aug. 1968 p 33–50 In GERMAN (See N69-26467 14-02)
Avail: CFSTI

Measurements have been performed with steel blade rotors and also rotors with composite material blades fitted to Alouette

II helicopters. A description is given of the measuring instruments and data are presented for the bending moments and torsional stresses as functions of the flight speed and the attitude of the helicopter. Author (ESRO)

N69-26469# Bolkow Entwicklungen K. G., Munich (West Germany).
COMPARISON OF COMPUTED AND FLIGHT MEASUREMENTS OF THE BOELKOW JOINTLESS ROTOR SYSTEM [VERGLEICH VON RECHNUNGEN UND FLUGMESSUNGEN AN EINEM GELENKLOSEN ROTOR SYSTEM BOELKOW]
M. Rade *In* WGLR Helicopter Flight Meas. Aug. 1968 p 73–109 refs In GERMAN (See N69-26465 14-02)
Avail: CFSTI

Stability, blade torques, blade velocity, control, power requirements and ground effects were measured during flight tests of the BO-105 helicopter and the results are compared with theoretical computations. ESRO

N69-26470# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
CONTROLLABILITY MEASUREMENTS ON HELICOPTERS [STEUERBARKEITSMESSUNGEN AN HUBSCHRAUBERN]
G. Engel *In* WGLR Helicopter Flight Meas. Aug. 1968 p 111–136 refs In GERMAN (See N69-26465 14-02)
Avail: CFSTI

Control and stability measurements have been performed with a helicopter flight simulator and on a pilotless, remote-controlled drone helicopter Do 32U. The cross-correlation between the pilot's actions and the helicopter response has been established and psychological factors taken into account. Results are given for the S-58 helicopter and the Hughes XV-9A helicopter. ESRO

N69-26471# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
FLIGHT MECHANIC PROBLEMS OF THE UNMANNED ROTOR PLATFORM Do 32 K [FLUGMECHANISCHE PROBLEME DER UNBEMANNTEN ROTORPLATTFORM Do 32 K]
U. Thenhausen *In* WGLR Helicopter Flight Meas. Aug. 1968 p 137–162 refs In GERMAN (See N69-26465 14-02)
Avail: CFSTI

Stability problems of the Do 32 K platform have been flight tested. Equations of motion are discussed and the wind effects on the mooring cable have been taken into account. A simulation program was established and used to study the stability of the platform for several lengths of cable. ESRO

N69-26472# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany).
MEASUREMENTS ON VERTOL H-21 HELICOPTER [MESSUNGEN MIT DEM HUBSCHRAUBER VERTOL H-21]
R. Schroeder *In* WGLR Helicopter Flight Meas. Aug. 1968 p 163–187 refs In GERMAN (See N69-26465 14-02)
Avail: CFSTI

Results are given of flight test programs on the tandem Vertol H-21 helicopter. Special attention is devoted to blade flapping motion and blade deflection during horizontal flight. The blade deflection was measured with a high speed camera and the results are given in the form of curves. ESRO

N69-26646# Frost Engineering Development Corp., Englewood, Colo.
DESIGN, DEVELOPMENT, TEST, AND FABRICATION OF CARGO PARACHUTE RELEASE ASSEMBLY, 12,000-POUND CAPACITY
Ronald L. Criley and Ivor R. Smith Natick, Mass. Army Natick Labs. Dec. 1968 71 p
(Contract DAAG17-67-C-0197)
(AD-683211; NLARS-TR-69-56-AD) Avail: CFSTI CSCL 1/3

A tilt-type cargo parachute release assembly having suspended cargo capacity of 12,000 pounds was developed. Static and dynamic structural tests plus a series of airdrop tests were conducted with three 12,000-pound capacity release fabricated for test. These tests demonstrated that the developed units met all the design, performance, and service requirements. Author (TAB)

N69-26738# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
COCKPIT NOISE INTENSITY: ELEVEN TWIN-ENGINE LIGHT AIRCRAFT
Jerry V. Tobias Oct. 1968 10 p refs
(AM-68-25) Avail: CFSTI

Eleven of the most popular twin-engine general-aviation light aircraft were tested for the noise intensity present during normal cruising operations at 2,000, 6,000, and 10,000 feet MSL (mean sea level). Although generally quieter than single-engine planes, these aircraft, in comparison with currently accepted damage-risk criterion curves, have noise levels (even in the quietest plane tested) that could be damaging. However, a well fitted pair of earplugs should protect against the physiologically damaging noise intensities encountered in this study. Author

N69-26873# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
A PRE-FLIGHT SIMULATION OF THE BAC 221 SLENDER-WING RESEARCH AIRCRAFT
A. McPherson London Aeron. Res. Council 1969 30 p refs Supersedes RAE-TR-66165; ARC-28859
(ARC-R/M-3582; RAE-TR-66165; ARC-28859) Copyright. Avail: CFSTI; HMSO 13s

A piloted simulation study of the handling characteristics of the BAC 221 aircraft in the approach configuration was made in preparation for the first flight of the aircraft. The simulation included a simplified representation of the outside visual world, and cockpit motion in pitch and roll. Values of the aircraft's lateral derivatives and moments of inertia were varied to allow for uncertainties in the predicted aircraft characteristics. Optimum control gearings and centre of gravity position for first flight were also investigated. The Fairey Delta 2 aircraft, from which the BAC 221 derives, was also simulated to allow comparison with existing flight experience. Since the completion of the simulation the first flight of the BAC 221 has made possible a retrospective assessment of the value of the simulation. Author (ESRO)

N69-26892# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
VARIABLE STABILITY AND CONTROL TESTS ON THE SC 1 AIRCRAFT IN JET-BORNE FLIGHT, WITH PARTICULAR REFERENCE TO DESIRABLE VTOL FLYING QUALITIES
J. K. B. Illingworth and H. W. Chinn Aeron. Res. Council 1969 35 p refs Supersedes RAE-TN-Aero-2895; ARC-25001
(ARC-R/M-3584; RAE-TN-Aero-2895; ARC-25001) Copyright. Avail: CFSTI; HMSO 16s 6d

The note describes a series of tests made on the S.C.1 variable stability VTOL aircraft in hovering and low speed flight, with various amounts of autostabilization. The measurements made cover control power, damping, trim, engine response and ground effect. Pilot opinions of the flying qualities of the aircraft in

different conditions are correlated with its measured characteristics, including the time taken to perform manoeuvres. Conclusions are drawn about desirable flying qualities for VTOL aircraft, and are compared with those obtained from other similar flight tests.
Author (ESRO)

N69-27084# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
RESONANCE TESTS ON A BEAGLE B206 SERIES 1 AIRCRAFT
F. J. Hawkins and R. F. Mousley 1969 29 p refs
(RAE-R/M-3589; RAE-TR-66309; ARC-29150) Supersedes RAE-TR-66309; ARC-29150 Copyright. Avail: CFSTI; HMSO 13s

Ground resonance tests were conducted on a Beagle B206 light aircraft. The modes of vibration in the frequency range up to 47·4 Hz were investigated with multipoint excitation using the GRAMPA equipment. The modes obtained are discussed in the report. Comment is also made on the short time and small effort required to conduct these tests.
Author

N69-27095# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
LOW-SPEED WIND-TUNNEL TESTS ON THE EFFECTS OF TAILPLANE AND NACELLE POSITION ON THE SUPERSTALL CHARACTERISTICS OF TRANSPORT AIRCRAFT
D. J. Kettle and D. A. Kirby Aug. 1967 51 p refs (Supersedes RAE-TR-67197; ARC-29746)
(RAE-R/M-3571; RAE-TR-67197; ARC-29746) Copyright. Avail: CFSTI; HMSO £1 1s 6d

Measurements of lift, drag, and pitching moment were made on several model configurations for wing incidences up to 53°. Tailplane and nacelle size and position were varied independently and the results confirmed that aircraft with engines mounted at the rear of the body and a high-tailplane position face severe superstall problems. For such layouts deep penetration of the stall could lead to a stable trimmed condition at a high incidence where the tailplane is in the wake of the wing and nacelles and is incapable of ensuring a recovery to normal flying attitudes. The advantage of using low-tailplane positions and of increasing the tail arm to allay the superstall problem was clearly demonstrated by the tests. Several other trends which it is considered will be of guidance to the future designer were also noted; but because of the complexity of the flow at the tailplane it is recommended that the wind tunnel programs on all future layouts should include some tests at very high incidence.
Author

N69-27115# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DEVICE FOR LOADING AIRCRAFT DURING STATIC TESTS
A. N. Baranov et al 15 Nov. 1968 5 p Transl. into ENGLISH from Russian Patent no. 200845 (Appl. no. 1102714/40-23, 2 Oct. 1967) 2 p
(AD-684018; FTD-HT-23-1028-68) Avail: CFSTI CSCL 1/3

The report introduces a device for loading aircraft during static tests. The reliability of the unit is improved by using pressure reducers made in the form of two coaxial cylinders of different diameters with their pistons interconnected by a rod. The casing of the smaller cylinder is a replaceable sleeve.
Author (TAB)

N69-27177*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EVALUATION OF A CONTACT-ANALOG DISPLAY IN LANDING APPROACHES WITH A HELICOPTER
Robert W. Sommer and R. Earl Dunham, Jr. Washington Jun. 1969 25 p refs
(NASA-TN-D-5241) Avail: CFSTI CSCL 01D

The contact-analog presentation included an inclined pathway, fixed in a ground-coordinate system, that provided information for slope and course guidance. The tests were conducted along a 8° glide slope at approach speeds of about 30 knots to a breakout that was followed by a visual slowdown to hover. The tests of the display showed that because of the limited horizontal view of the contact analog (24°) and an incorrect generation of the lateral movement of the pathway, the pilots were constrained to fly within ±100 feet (±30.48 m) laterally of the path center line. The use of the pathway for slope control was found to be difficult because of the limited vertical view of the contact analog (18°) and the necessity of flying an appreciable distance above the pathway to prevent inversion of the pathway. For the slope offset of the present tests (50 feet (15.24 m)), the nearest visible part of the pathway was a considerable distance ahead of the helicopter; thus slope deviations were difficult to detect. The display also presented an unrealistic quality because of the relative motions of the ground grid and the pathway tip.
Author

N69-27188# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS OF THE STRUCTURAL STRENGTH OF AIRCRAFT
F. Obratztsov 8 Feb. 1968 17 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), 1967 p 31–40
(AD-683180; FTD-HT-23-1663-67) Avail: CFSTI CSCL 1/3

The article deals with wing forms, particularly the delta shape and the strains and stresses that go with it. Computers have been used to design wings. Variable wings are compared to fixed wings. Aerodynamic heating is taken into consideration. Creep is discussed. The shell theory is introduced. The main problem is raising the theoretical level of applied computation methods, making them more reliable and striving for their effective numerical accomplishment based on the achievements of modern mechanics, mathematics, computer technology and experimental methods.
Author (TAB)

N69-27314# National Aerospace Lab., Tokyo (Japan).
INVESTIGATIONS ON THE STABILITY AND CONTROL CHARACTERISTICS OF A TWIN PROPELLER STOL AIRPLANE
Goro Beppu 1968 57 p refs In JAPANESE; ENGLISH summary NAL-TR-163) Avail: CFSTI

Analytical investigations on the stability and control of a twin propeller STOL aircraft, which is equipped with powerful flaps and utilizes the propeller slipstream, were conducted. The peculiar properties of this airplane in landing conditions are determined. Among these are included the low speed and propeller slipstream factors and the responses to elevator deflection are different from those of normal aircraft. Also the airplane is very sensitive to horizontal gust. The change of flight path due to power to change is so quick and large that power can be utilized as direct lift control when the time delay of power response to throttle manipulation is small. In the power backside flight condition, the flare operation in landing should be performed quickly near ground because of the response to elevator defection.
Author

N69-27318# Granger Associates (Dorne and Margolin), Bohemia, N.Y. Military and Airline Equipment Div.
CRAB ANGLE SENSING SYSTEM (CASS)
George Birutis Mar. 1969 80 p refs
(Contract FA-68-WA-1894)
(SRDS-RD-69-18) Avail: Issuing activity

The Crab Angle Sensing System (CASS) has been designed and developed. The purpose of the CASS system is to provide a continuous indication of the angle between the axis of the aircraft and the centerline of the runway during aircraft landings. Employed in CASS are the principles of a lobe switching RF system, utilizing existing navigation equipment. The installation of such a system in typical aircraft would require a minimum of modification to aircraft equipment. The feasibility of the design concept of CASS was successfully demonstrated during aircraft tests in December 1968. Calculated probable error in the measurement of bearing angle was less than 0.5°. Based on the total data obtained during the test program discussed in this report, it is concluded that CASS is a feasible system for providing a d-c voltage proportional to the crab angle of the aircraft. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-26168# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DISMOUNTABLE THERMIONIC CONVERTER

V. I. Petrov et al. 6 Nov. 1968 9 p ref Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSSR (Moscow), v. 6, no. 1, 1968 p 203–206

(AD-683961; FTD-HT-23-906-68) Avail: CFSTI CSCL 10/2

A report is given on a thermionic converter, differing in that it uses mica packing rather than copper or nickel, allowing dismantleability of the converter. The converter has cylindrical electrodes, and is operated in a vacuum chamber. When using synthetic mica, no significant change of insulating properties or of mica transparency was observed after 100-150 hours of operation. The cathode is heated with a coaxial tungsten filament. Author (TAB)

N69-26189# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A COMPARISON OF MAGNETIC SYSTEMS FOR PRODUCING STRONG LARGE-VOLUME FIELDS

Ye. L. Zaremba et al. 31 Oct. 1968 24 p refs Transl. into ENGLISH from Magnitn. Gidrodinam., Akad. Nauk Latv. SSR (Riga), no. 4, 1967 p 124–134

(AD-683989; FTD-MT-24-375-68) Avail: CFSTI CSCL 10/2

Four types of magnetic systems are analyzed and compared with regard to their suitability for use in large-scale MHD power generators. The four types discussed are: (1) an ironless coaxial magnetic system with a tangential field, (2) an ironless elliptical-type system with a winding in the form of two intersecting ellipses or circles, (3) an O-shaped system with a magnetic circuit, and (4) a diamond-shaped system with a magnetic circuit. The tabular data show the advantages of the elliptical system over the others for the whole range of the excitation energy, which is a function of the relative thickness of the current layer. The diamond-shaped system is preferred, however, if losses can be reduced by reducing the resistivity of the winding material. In the magnetic systems analyzed, excitation losses amount to about 10% of the generated energy, provided the MHD generator is sufficiently large. TAB

N69-26240*# Oak Ridge National Lab., Tenn. Reactor Div.

DESIGN COMPARISON OF CESIUM AND POTASSIUM VAPOR TURBINE-GENERATOR UNITS FOR SPACE POWER PLANTS

A. P. Fraas, D. W. Burton, M. E. LaVerne, and L. V. Wilson Feb. 1969 166 p refs

(NASA Order W-12353; Contract W-7405-ENG-26)

(NASA-CR-101122; ORNL-TM-2024) Avail: CFSTI CSCL 10A

From a review a basic set of design precepts was developed to provide a self-consistent set of bases for the study. The next phase of the work entailed a parametric study to determine the effects on turbine efficiency, size, and other key parameters of variations in the number of stages, the rpm, the turbine inlet and exhaust temperatures, and effects of various losses such as aerodynamic, seal leakage, moisture churning, and bleed-off for regenerative feed heating. A two-stage and a three-stage cesium turbine and a five-stage and an eight-stage potassium turbine were chosen as reference designs for detailed analytical and layout studies. Layouts were prepared and analyses made of the major problems including creep stresses in the turbine rotors, temperature distribution and thermal stresses in the turbine rotors, the dynamics of the bearings and rotors, and moisture formation, deposition, and possible turbine bucket erosion. Author (NSA)

N69-26531# National Gas Turbine Establishment, Pyestock (England).

SOME AERODYNAMIC ASPECTS OF TURBINE DESIGN

J. Dunham and D. J. L. Smith *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 18 p refs (See N69-26526 14-28)

Avail: CFSTI

A turbine was designed for optimum efficiency, and achieved on test its predicted performance. The peak efficiency was 92-1/2%. During design studies, it was found that the three dimensional nature of the flow influenced the blade surface pressure distribution considerably, and this, coupled with a marked disagreement between boundary layer theories as to the maximum permissible blade loading, led to the use of an empirical rule. Boundary layer theory was found to predict profile loss well, however. Another turbine fitted with variable nozzle guide vanes was tested. It was less efficient than predicted, because the nozzle end clearances needed to permit their movement caused greater losses than expected. Small flow changes cost little more efficiency but a 33% flow reduction lost 10% efficiency. Author

N69-26532# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

AERODYNAMIC PROBLEMS IN COOLED TURBINE BLADING DESIGN FOR SMALL GAS TURBINE

J. Chauvin, K. Papailiou, and L. Burrows (Army Aviation Mater. Labs.) *IN* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 22 p refs (See N69-26526 14-28)

Avail: CFSTI

The next generation of small gas turbines (in the 500 to 1000 shp range) will have to use turbine inlet temperatures of the order of 1200°C, if specific fuel consumption and specific power better than those of piston engines must be reached. Such temperatures can be realized only if cooling of the nozzle and blades of the compressor turbine is used. Air and liquid cooling are being considered. Strength and space requirement lead to the use of thick blades, especially at the trailing edge, and having a minimum chord length of several centimeters. The mass flow to handle leads to small passages height and therefore to aspect ratios of the order of 0.4. High losses are generated due to blade profile, trailing edge thickness and above all, secondary losses. A review is made of the research in the field of blade optimization and in the analysis and reduction of secondary flows and losses, (wall shaping etc.). Author

N69-26533# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

TRANSONIC TURBINE BLADING

C. Sieverding *IN* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 22 p refs (See N69-26527 14-28)

Avail: CFSTI

A transonic cascade for a pitch chord ratio of 1.3 and a stagger angle of 65° was designed and tested over a wide range of pressure ratios. A second design showed the effect of a change in L.E. and T. E. profile on the cascade performance. A new measuring device allowed a detailed determination of the transonic flow in the throat region between two neighboring blades. Author

N69-26600*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CAVITATION PERFORMANCE OF 84° HELICAL PUMP INDUCER OPERATED IN 37° AND 42° R LIQUID HYDROGEN

Calvin L. Ball, Phillip R. Meng, and Lonnie Reed Washington Feb. 1967 19 p refs

(NASA-TM-X-1360) Avail: CFSTI CSCL 13K

The performance of a flat-plate helical-pump inducer with a blade-tip helix angle of 84° and a constant lead was evaluated. The tests were conducted at a rotative speed of 20,000 rpm, over a range of flow rates from 900 to 1635 gallons per minute at several values of net positive suction head. An improvement in pump cavitation performance was indicated at 42°R. The required net positive suction head for a given loss in inducer head rise in 37°R liquid hydrogen was at least 90 feet less than that required with 80°F water at a flow coefficient of 0.076. Because of this difference in suction requirements, which is attributed to the effect of fluid properties, the inducer can pump boiling liquid hydrogen at low flow coefficients with no appreciable head loss. Photographs of inducer cavitation in liquid hydrogen are presented. Author

N69-26620# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELEMENTS OF THE GENERAL THEORY OF TRANSIENT WORK PROCESSES OF LIQUID-METAL MHD CONDUCTION TYPE GENERATORS

A. N. Patrashev, A. G. Ryabinin, and A. I. Khozhainov 12 Jul. 1968 45 p refs Transl. into ENGLISH OF Akad. Nauk SSSR, Inst. Vysokikh Temperatur (USSR) 33 p

(AD-680712; FTD-HT-23-586-68) Avail: CFSTI CSCL 10/2

The theoretical research is applicable to a laminar flow regime of the liquid metal in the channel of an MHD generator. These flow conditions can be the working conditions. In addition, at high speeds of the liquid metal the flow conditions can be turbulent. An analysis of the attained solutions has made it possible to establish that during laminar flow conditions of a liquid metal, for a description of the change with respect to time of the integral parameters of the flow, one can successfully make use of a quasi-stationary approximation taking into account frictional forces. Author (TAB)

N69-26722# Harry Diamond Labs., Washington, D.C.

FLUERICS. 1: BASIC PRINCIPLES

J. M. Kirshner Nov. 1968 43 p refs

(AD-683495; HDL-TR-1418) Avail: CFSTI 13/7

After a brief historical introduction, the physical phenomena underlying most flueric devices are discussed. Brief descriptions of the operation of proportional and binary devices of various kinds are given including wall attachment, momentum interaction, vortex, and turbulence devices. Author (TAB)

N69-26822# Gulton Industries, Inc., Metuchen, N.J. Research and Development Div.

DESIGN, FABRICATION OF PROTOTYPES, AND TESTING OF SEALED, RECHARGEABLE SILVER–CADMIUM CELLS Final Report, Feb. 1967–Oct. 1968

S. Charlip, R. Michaels and R. Katz Feb. 1968 35 p

(Contract DA-36-039-AMC-03358(E))

(AD-683466; ECOM-03358-F) Avail: CFSTI CSCL 10/3

The manufacture of the pasted silver electrodes and of the pressed cadmium electrodes is described. Both electrodes have pure silver substrates of one-piece construction. The separator system used in the sealed cells is delineated. Cell construction and assembly is given in detail, with accompanying drawings. The activation and formation procedures for cells are described. The report gives the capacities obtained from engineering evaluation tests for room and high temperature storage, cold temperature, and early data on cycle life. The results of the tests and conclusions to be drawn from them are discussed. Author (TAB)

N69-27108# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EXPERIMENTS ON SIRENE IN-PILE THERMIONIC CONVERSION AND EXAMINATION AFTER IRRADIATION OF THE SIRENE 302 CONVERTER [EXPERIENCES DE CONVERSION THERMO-IONIQUE SIRENE EN PILE ET EXAMENS APRES IRRADIATION DU CONVERTISSEUR SIRENE 302]

J. Bliaux, M. Clemot, B. Devin, and P. Dumas [1968] 14 p refs In FRENCH Presented at the 2d Intern. Conf. on Thermionic Elec. Power Generation, Stresa, Italy, 27–31 May 1968

(CEA-CONF-1042; CONF-680508-7) Avail: AEC Depository Libraries

Lifetime experiments made in the Triton swimming pool reactor are reported. The three converters described are similar and were irradiated in individual capsules. The emitting surface is 20 cm^2 and has a pyrolytic covering of W. The interelectrode space is 0.2 mm. The Cs pressure is controlled by the temperature of a graphite block (which is close to that of the collector) or by the temperature of a classic Cs reservoir. Lifetimes of the order of 2000 hrs were obtained. The measurements made during these tests are presented. The results of the post-irradiation examination of the Sirene-302, made in a hot cell, are also presented; perturbation of the emitting surface, UO_2–Mo reaction, evaporation transfer of UO_2, behavior of the graphite, and verification of the short circuit emitter-collector. These results confirm those obtained previously in laboratory experiments. Author (NSA)

N69-27256# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

METAL-AIR CELLS

Hyman J. Mandel, Martin J. Sulkes, Otto C. Wagner, and Howard R. Knapp Dec. 1968 28 p refs

(AD-683461; ECOM-3061) Avail: CFSTI CSCL 10/3

Information is presented on primary magnesium-air and secondary cadmium-air, zinc-air and iron-air systems. Performance data and problems in cell design are reviewed. Estimates of energy densities for the four systems range from 40 to 80 Wh/lb. Modifications of anode make-up and electrolyte composition have improved capacity and cycle life. The use of platinum air cathodes in rechargeable (secondary) metal-air cells avoids the decrease in energy density that otherwise would occur if non-noble metal air cathodes, in combination with auxiliary charging electrodes, were used. Electrode-electrolyte balance, active anode material utilization, water balance, dendrite formation, carbon dioxide contamination, etc. are among the areas which have been studied and which require further investigation. Author (TAB)

N69-27349# Kernforschungsanlage, Juelich (West Germany). Institut fuer Technische Physik.
ENERGY CONVERSION BY MEANS OF THERMIONIC DIODES [ENERGIEWANDLUNG MIT THERMIONISCHEN DIODEN]
V. Bundschuh, R. Butz, H. A. Claassen, B. Krahl-Urban, E. A. Niekisch et al Oct. 1968 96 p refs In GERMAN Presented at Seminar on the Status of Thermionic Res., Juelich, West Ger., Oct. 1968
(JUL-553-TP) Avail: CFSTI

Thermionic diode energy conversion processes discussed during this symposium cover: (1) conversion efficiency and technical application of thermionic diodes; (2) cesium diode performance in arc mode; (3) geometrical structure of cesium diodes; (4) effects of discharge potential, temperature, and emittance energy on optimal electrode spacing in cesium diodes; (5) production and thermionic utilization of high emittance metal surfaces; and (6) high temperature nuclear fuels for thermionic emitters. Transl. by G.G.

N69-27397# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ENIN-2 EXPERIMENTAL OPEN-CYCLE MHD GENERATOR RIG [EKSPERIMENTALNAYA USTANOVKA MGD-GENERATORA OTKRYTOGO TSIKLA ENIN-2 SM-107/159]
D. G. Zhimerin et al 12 Aug. 1968 14 p Transl. into ENGLISH from Russian publication
(AD-683131; FTD-MT-24-175-68) Avail: CFSTI CSCL 10/2

An experimental rig has been set up to study the processes taking place in the duct of an open-cycle MHD generator. The installation consists of a combustion chamber unit in which natural gas is oxidized in an air atmosphere enriched in oxygen (up to pure O2) with ionizing seeds of different types. The pressure in the duct can go up to 50 atm and the temperature to 3500K. As the combustion products pass into the duct, the nozzle system can vary the Mach number from subsonic to Mach 3. The duct has a rectangular section. Its maximum dimensions, determined by the magnet bore, are 0.2 x 0.34 x 2.5 m. The ducts are interchangeable to give the possibility of varying the area modification law relating to the section along the axis of the duct and of altering the electrode circuit or the size of the electrodes or insulation gaps, etc. The combustion chamber, nozzle and duct are made of stainless steel and are water-cooled; a coating of aluminum oxide serves as insulation. Depending on the mode of operation, the installations calculated power and electric power are in the neighborhood of 250 MW and 10 MW, respectively. TAB

N69-27561# National Aerospace Lab., Tokyo (Japan).
FUNDAMENTAL ANALYSES OF GIMBAL-ENGINE POSITIONING HYDRAULIC CONTROL SYSTEM USING A DPF SERVOVALVE
Shigeki Hatayama and Hajime Koshiishi 1968 23 p refs In JAPANESE; ENGLISH summary
(NAL-TR-166) Avail: CFSTI

Discussed is the synthesis of a hydraulic control system for positioning a gimbal engine that provides compensation methods for the damping of low resonance vibrations originating from the rocket engine. Analyzed are the following possible methods of compensation: (1) pressure feedback; (2) dynamic pressure feedback; and (3) compensatory dynamic pressure feedback. Proposed are techniques for determining the values of the compensatory constants. The validity of the fundamental analysis is verified by analog computer simulation. It is shown that for best compensation the dynamic characteristics of all three methods are similar, but that the static characteristics are different. The pressure feedback method lacks actuator stiffness, but the actuator stiffness for the dynamic pressure feedback method is infinite. The compensatory dynamic pressure feedback method provides better static characteristics than the dynamic pressure feedback technique and controls the engine angle precisely. Compensation elements in all three elements constitute hydraulic circuits and optimal compensatory control by reducing the synthesizing servovalves to one functional element. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-26158# System Development Corp., Santa Monica, Calif.
OPTIMUM RESPONSE TO ALERTING SIGNALS AND WARNING MESSAGES
Bill D. Miller 14 Mar. 1969 176 p refs
Avail: Issuing Activity

Determination of how people perceive and respond psychologically to alerting signals and warning messages is investigated. The first part describes the goals, methodology, and findings of a study conducted as part of the total plan and presents procedures, using the findings of the study to optimize warning message construction. The remaining two parts of the research plan are research study designs. Author

N69-26187 California Univ., Los Angeles.
COAXIAL BRIDGE METHODS FOR MEASURING THE MICROWAVE DIELECTRIC PROPERTIES OF AQUEOUS SOLUTIONS: APPLICATION IN A STUDY OF THE NATURE OF HEME-HEME INTERACTIONS IN HEMOGLOBIN
Allen Paul Minton (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-16613

The propagation of electromagnetic waves through matter is discussed from the macroscopic point of view and relationships between relevant dielectric parameters are developed. The theory, apparatus, and measuring techniques of the coaxial bridge methods introduced here are described and their suitability for the proposed measurements as compared to that of previously reported methods is discussed. The phenomenon of subunit interaction in hemoglobin and its relationship to the physiological function is discussed. A general equation describing the equilibrium oxygen binding behavior of hemoglobin in terms of subunit properties and internal energy changes is developed. The Libby hypothesis of subunit interaction, based upon the concept of ligand-dependent London dispersion forces acting between the conjugated pi-electron systems of the hemes, is elaborated. The energetic requirements of the hypothesis are discussed in terms of transition dipole strength, frequency, and the static electronic polarizability of the heme. Dissert. Abstr.

N69-26213# Naval Radiological Defense Lab., San Francisco, Calif.
ASSESSMENT OF RADIATION DAMAGE TO THE HEMATOPOIETIC CELLS OF MICE-DEPENDENCE OF D_0 ON THE SIZE OF ENDOGENOUS SPLEEN NODULES
Earl J. Ainsworth, Rex M. Larsen, and Adam E. McKee 31 Dec. 1968 22 p refs
(AD-683864; USNRDL-TR-69-2) Avail: CFSTI CSCL 6/16

The colony-forming unit (CFU) exhibits many properties of the hematopoietic stem cell, and CFU methodology has been extensively used in many laboratories to assess radiation damage to the hematopoietic system of mice. The radiation responses of CFUs may be measured by either the endogenous or the transplantation

method, and with either method, the number of spleen nodules decreases exponentially with increasing radiation exposure. Author (TAB)

N69-26275 Cornell Univ., Ithaca, N.Y.
SPARK SOURCE MASS SPECTROGRAPHIC METHOD FOR THE SURVEY ANALYSIS OF TRACE ELEMENTS IN BIOLOGICAL MATERIALS
Charles Andrew Evans, Jr. (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-15716

A technique is presented which allows time resolution of the ions produced by the radio frequency pulse. Time resolution results are presented for three different matrices, iron, graphite, and 50:50 biological ash:graphite. The biological samples were ashed by a low temperature ashing technique to remove hydrocarbon interferences. Although inorganic interferences resulted from the complex ash matrix, most were easily detected by careful evaluation of the spectrum. To correct for instrumental conditions and matrix effects, each unknown was doped with a mix containing about 60 elements providing the best possible comparative standard. The concentrations, thus calculated, correlated quite well with those of the elements detected by a sensitive emission spectrographic method. In addition, the mass spectrograph detected 21 additional elements and provided excellent detection limits for 20 to 30 more. Dissert. Abstr.

N69-26294# School of Aerospace Medicine, Brooks AFB, Tex.
ESTIMATION OF SERUM PROTEINS BY QUANTITATIVE DENSITOMETRY AFTER GEL ELECTROPHORESIS
Emmanuel L. Mosser and Dale A. Clark Dec. 1968 16 p refs
(AD-683719; SAM-TR-68-133) Avail: CFSTI CSCL 6/1

The problem of obtaining quantitative results from polyacrylamide gels was approached by modifying a commercially available densitometer designed for paper electrophoresis. The light beam was collimated into a thin sheet which passed through the diameter of the cylinder of gel as the latter was advanced continuously. The recorded densitometric trace was integrated manually and the fractional areas of albumin, transfenin, and macroglobulin bands were studied for reproducibility. Replicate analyses of various steps were performed and duplicate runs of five serum samples were made. The standard deviation of the overall procedure for each of the three fractions studied was 5-10% of the measured levels. It was concluded that, used with care, the technique can provide valuable qualitative information as well as quantitative data. Author (TAB)

N69-26301# Michigan Univ., Ann Arbor. Human Performance Center.
HUMAN INFORMATION HANDLING PROCESSES Annual Report, 1 Jun. 1967–31 May 1968
Arthur W. Melton Jun. 1968 46 p
(Contract AF 49(638)-1733; ARPA Order 461)
(AD-683735; AFOSR-69-0486TR; REPT-08773-21-A; MR-4; AR-1) Avail: CFSTI CSCL 5/10

A review is given of research carried out on human performance in information processing and memory. Experimental results and theoretic progress are presented on the following topics: Taxonomy of information handling process; Selective information handling process (which includes selective responding to stimuli, human adaptive capacities in optimizing performance, and decision theoretic interpretations of information processing performance); Information storage and retrieval (which includes modeling of short-term memory); Refinement or resolution of certain critical issues; and Refinement of short-term-memory methods and measures. Author (TAB)

N69-26316*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
ABUNDANCE OF MICROFLORA IN SOILS OF DESERT REGIONS
Roy E. Cameron 15 May 1969 21 p refs
(Contract NAS7-100)
(NASA-CR-101127; JPL-TR-32-1378) Avail: CFSTI CSCL 08G

Surface soils were collected by aseptic techniques from cold, polar, hot volcanic, and high mountain deserts, and were analyzed for physical, chemical, and microbiological properties. Soils showed a wide range of properties but were generally greyish, yellowish, or brownish sands, low in organic matter and cation exchange capacity. There were detectable concentrations of water-soluble ions, and pH values above 7.0, except in volcanic areas. Total microbial abundances ranged from zero (undetectable) to $> 10^8$/gm of soil. Aerobic and microaerophilic bacteria were most abundant, followed by algae and molds. The anaerobic bacteria were generally least abundant or undetectable. Predominant microflora included *Bacillus* spp., soil diphtheroids, *Schizothrix* spp. and other oscillatorioid blue-green algae, *Streptomyces* spp., *Penicillium* spp., and *Aspergillus* spp. Author

N69-26327# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 3, NUMBER 1, 1969
14 May 1969 194 p refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, vol. 3, no. 1" Moscow, Meditsina, 1969 p 1–110
(JPRS-48042) Avail: CFSTI

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8. CHANGES IN CALCIUM METABOLISM IN RATS DURING HYPOKINESIA B. B. Yegorov et al p 85–91 refs (See N69-26335 14-04)

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14. CHARACTERISTICS OF HUMAN METABOLISM DURING 120-DAY NUTRITION WITH DEHYDRATED DIETS V. P. Bychkov p 139–147 refs (See N69-26341 14-04)

15. EFFECT OF HYPOKINESIA, ACCELERATION AND REDUCED NUTRITION ON THE STATE OF THE BLOOD-COAGULATION SYSTEM IN MAN O. D. Anashkin p 148–156 refs (See N69-26342 14-04)

16. BLOOD CIRCULATION IN CEREBRAL AND SURFACE VESSELS OF THE HUMAN HEAD UNDER THE INFLUENCE OF ACCELERATIONS A. S. Barer et al p 157–164 refs (See N69-26343 14-04)

17. GAS CHROMATOGRAPHIC DETERMINATION OF VOLATILE SUBSTANCES CONTAINING OXYGEN IN FLUID BIOLOGICAL MEDIA Yu. V. Pepelyayev et al p 165–174 refs (See N69-26344 14-04)

18. EFFECT OF SIMULTANEOUS EXPOSURE TO HYPOXIC HYPOXIA AND HIGH AMBIENT TEMPERATURE ON HUMAN HEAT EXCHANGE A. N. Azhayev p 175–179 refs (See N69-26345 14-04)

N69-26328# Joint Publications Research Service, Washington, D.C.

SCIENTIFIC WORK ON THE MOTOR REGIME AS AN IMPORTANT BASIS FOR THE PSYCHOPHYSIOLOGICAL TRAINING OF A COSMONAUT

A. V. Korobkov *In its* Space Biol. and Med., Vol. 3, No. 1, 1969 14 May 1969 p 1–10 (See N69-26327 14-04)
Avail: CFSTI

The tolerance of human body functions to space flight factors is ensured by systematic physical training with increased adaptive capabilities of the body. High level physical readiness of astronauts assures rapid and stable performance of complex motor actions, determines favorable psychophysiological responses to extreme factor exposures, and brings a speedy restoration of the initial state of body functions after negative factors cease to operate. G.G.

N69-26330# Joint Publications Research Service, Washington, D.C.

PROBLEMS IN SPACE PHARMACOLOGY

V. V. Parin et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 27–47 refs (See N69-26327 14-04)
Avail: CFSTI

Reviewed are the basic principles for organizing a spaceship onboard medical pharmacy depending on the duration, purpose, and nature of the flights. Considered are body reactions to medicines, acceleration, irradiation, anabiosis, sleep-wakefulness cycle, immobilization, weightlessness, vestibular disorders, and physical work. Pharmacological defense methods include the use of vasoconstrictive and antihypoxic substances as well as pharmaceuticals that attenuate local changes in the lungs and prevent the development of atelactasis, edema, or hemorrhages. G.G.

N69-26331# Joint Publications Research Service, Washington, D.C.

CIRCADIAN RHYTHMS AND THEIR IMPORTANCE FOR SPACE BIOLOGY AND MEDICINE

G. K. Mikushkin *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 48–80 refs (See N69-26327 14-04)
Avail: CFSTI

Changes in diurnal and circadian rhythms of man during space flight conditions were evaluated and the formation of new rhythms in test subjects was discussed. It was concluded that a stable synchronization of physiological rhythms in man was attainable only if rhythm periods did not exceed the limits from 21–22 to 27–28 hours. Restructuring of primary rhythms to stipulated rhythms occurred over a period of one to two weeks; the greater the difference between the two regimes in phase or frequency, the more rapid was the transition to the new regime. The author concluded that it was most important to establish the individual peculiarities of a man's circadian rhythm before forming a new biological rhythm. G.G.

N69-26332# Joint Publications Research Service, Washington, D.C.

HYPOTHALAMIC NEUROSECRETION AND SUPRARENAL CONDITIONS OF RATS UNDER HIGH-MOUNTAIN CONDITIONS

E. S. Gulyants et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 61–69 refs (See N69-26327 14-04)
Avail: CFSTI

Experiments were performed with 42 rats to study the response of their hypothalamic neurosecretion system to an altitude environment. Exposure of the animals to this environment caused an enhancement of the secretion-forming process in the hypothalamic-hypophyseal-adrenal system: a year after the exposure the animals developed adaptation which involved compensation-adaptation processes (in the form of a nonphysiological change of phases in the secretion cycle in secretory neurons). New properties of hypothalamic neurosecretion can be found in the first generation of rats born at such an altitude. Author

N69-26333# Joint Publications Research Service, Washington, D.C.

CHANGES IN STRIATED MUSCLE FIBERS OF MICE UNDER RESTRAINED CONDITIONS

V. V. Portugalov et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 70–79 refs (See N69-26327 14-04)
Avail: CFSTI

The quandriceps muscle of mice kept for 15 days under restrained conditions was investigated by electron microscopy. It was found that the myofibrillar apparatus, mitochondria and sarcoplasm of muscle fibers developed changes which appeared to be reversible. It is assumed that the changes serve as the material substrate underlying the muscular deconditioning and atrophy observed during hypokinesia. Author

N69-26334# Joint Publications Research Service, Washington, D.C.

EFFECT OF LONG-TERM PHYSICAL RESTRICTION OF AN ANIMAL ON SOME BODY FUNCTIONS

A. B. Kogan et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 80–84 (See N69-26327 14-04)
Avail: CFSTI

Long term immobilization effects in cats manifested themselves in considerable changes of the nervous and cardiac activities. Electrocardiographic tracings exhibited tachycardia of the paroxysmal type with a marked deformation of tet waves of the ventricular complex. Tracometric studies of footprints after restriction showed that the animals had a decrease in walking rate and temporary disruption of locomotion. Electroencephalographic brain waves rhythms showed a considerable reduced mean amplitude of basic activity waves. Also observed was a general slowing of motor indices. G.G.

N69-26335# Joint Publications Research Service, Washington, D.C.

CHANGES IN CALCIUM METABOLISM IN RATS DURING HYPOKINESIA

S. B. Yegorov et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 85–91 refs (See N69-26327 14-04)
Avail: CFSTI

Calcium metabolism in rats kept for 30 and 60 days under restrained conditions was analyzed using the radioactive isotope ^{45}Ca. The investigations covered the skeletal system of the animals. A significant decrease in ^{45}Ca incorporation into the bone tissue of restrained animals was noted. It reached the maximum value in the epiphyseal parts of the femur bones. The rate of ^{45}Ca elimination from the bone tissue of the test animals was greater than in the controls. Author

N69-26336# Joint Publications Research Service, Washington, D.C.

POSSIBILITY OF USING SWEET POTATOES AS A BASIC SOURCE OF CARBOHYDRATES IN HUMAN NUTRITION DURING SPACEFLIGHTS

V. P. Dadykin et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 92–99 refs (See N69-26327 14-04)
Avail: CFSTI

The possibility of using sweet potatoes as the main source of carbohydrates for spacecrew members is discussed. The results of comparative testing of ten varieties of this crop in open hydroponic installations and in the soil are presented. The dynamics of tuber formation is determined. The yield appears to be higher in hydroponic installations than in the soil. Three of the tested varieties show better yield, daily increase of the biomass and proportion of tubers and haulm. Author

N69-26337# Joint Publications Research Service, Washington, D.C.

PRODUCTION OF CHLORELLA BIOMASS WITH A HIGHER CONTENT OF SULFUR-CONTAINING AMINO ACIDS AND EVALUATION OF ITS NUTRITIVE VALUE

N. N. Verzilin et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 100–108 refs (See N69-26327 14-04)
Avail: CFSTI

Strains of Chlorella with a higher cysteine content were obtained using mutant feeders. Their suitability for mass cultivation in pilot plan installations is demonstrated. The biomass of freeze-dried algae was fed to white rats. The biomass of the resulting strains was consumed and assimilated by rats much better than that of standard strains. Author

N69-26338# Joint Publications Research Service, Washington, D.C.

BACTERICIDAL EFFECT OF SILVERED ACTIVATED CHARCOALS AND ION-EXCHANGE RESINS

S. V. Chizhov et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 109–116 refs (See N69-26327 14-04)
Avail: CFSTI

Various techniques for reducing silver applied to the surface of activated charcoals and ion-exchange resins were investigated. The silvered sorbents produced a significant bactericidal effect on *Bacterium coli*. Author

N69-26339# Joint Publications Research Service, Washington, D.C.

DECOMPRESSION PROBLEMS IN SPACE MEDICINE

I. M. Khazen *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 117–130 refs (See N69-26327 14-04)
Avail: CFSTI

The role of the autonomic nervous system in the mechanisms regulating the body functions during rapid decompression was studied in many comparative and physiologic investigations. A tolerance to pressure gradients can be achieved by applying an adequate physiologic stimulation to the regulatory systems which are primarily responsible for determining the muscle tone of the lungs. The experiments were carried out on rats. By comparing the results of experiments based on the application of physical training (swimming) and drugs it is possible to distinguish common features of regulatory mechanisms of the autonomic nervous system. As a result of 1–1 1/2 months of training with a gradually increasing but moderate intensity a complex of related protective mechanisms (reflex, neurohumoral, neuroendocrinal, etc.) develops. At all experimental stages the integrative role of the cerebral cortex in the autonomic-neuroendocrinal interaction can always be detected. Author

N69-26340# Joint Publications Research Service, Washington, D.C.

EFFECT OF HIGH-MOUNTAIN ACCLIMATIZATION OF BODY TOLERANCE TO EXPOSURE TO ENVIRONMENTAL FACTORS

P. I. Yegorov et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 131–138 refs (See N69-26327 14-04)
Avail: CFSTI

This paper presents data accumulated through observations of 22 lowland and highland residents who spent 45 days in the Tien Shan at elevations of 3300 and 4100 m above sea level. The functional condition of the human body was evaluated on the basis of a comprehensive study of the cardiovascular system, external respiration, optic and vestibular analyzers, as well as a morphologic and biochemical analysis of the blood during exposures of test subjects to accelerations, hypoxia, thermal and physical stresses. It was concluded that a month-long exposure of human beings to these elevations can increase overall body tolerance. It is recommended that mountain excursions be included in the cosmonaut training programs. Author

N69-26341# Joint Publications Research Service, Washington, D.C.

CHARACTERISTICS OF HUMAN METABOLISM DURING 120-DAY NUTRITION WITH DEHYDRATED DIETS

V. P. Bychkov *In its* Space Biol. and Med., Vol. 3, no. 1, 1969 14 May 1969 p 139–147 refs (See N69-26327 14-04)
Avail: CFSTI

Experiments with six test subjects who were kept for 120 days on dehydrated diets indicated that adaptation developed during the course of the first two or three months. Author

N69-26342# Joint Publications Research Service, Washington, D.C.

EFFECT OF HYPOKINESIA, ACCELERATION AND REDUCED NUTRITION ON THE STATE OF THE BLOOD-COAGULATION SYSTEM IN MAN

O. D. Aneshkin *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 148–156 refs (See N69-26327 14-04)
Avail: CFSTI

The effect of hypokinesia and reduced nutrition, as well as hypokinesia, accelerations and reduced nutrition on the coagulation system was studied in three series of experiments, each involving six test subjects. With a decrease in nutrition there were no noticeable changes in the blood coagulation system. During the course of a 15-day bedrest all the subjects exhibited a slight decrease in blood coagulation activity. During the combined effect of hypokinesia, accelerations and reduced nutrition, the changes in the coagulation system were most clearly expressed. Author

N69-26343# Joint Publications Research Service, Washington, D.C.

BLOOD CIRCULATION IN CEREBRAL AND SURFACE VESSELS OF THE HUMAN HEAD UNDER THE INFLUENCE OF ACCELERATIONS

A. S. Barer et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 157–164 refs (See N69-26327 14-04)
Avail: CFSTI

Blood circulation in the cerebral and surface vessels of the human head was investigated by rheoencephalographic and photoplethysmographic techniques upon exposure to accelerations of different magnitude (2 to 18 g) and direction. The level of pulse filling of the brain was found to be dependent on the magnitude of the acceleration component applied in a foot-to-head direction. Circulation in the external carotid artery was shown to change to a greater extent and at lower accelerations than circulation in cerebral vessels. Author

N69-26344# Joint Publications Research Service, Washington, D.C.

GAS CHROMATOGRAPHIC DETERMINATION OF VOLATILE SUBSTANCES CONTAINING OXYGEN IN FLUID BIOLOGICAL MEDIA

Yu. V. Pepelyayev et al *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 165–174 refs (See N69-26327 14-04)
Avail: CFSTI

A gas chromatographic method has been developed for quantizing acetaldehyde, propionic aldehyde, acetone, methanol, isopropanol, ethanol and isobutanol in liquid biological media. The method is based on the head-space sampling and flame-ionization detection methods. Separation is performed using polyethylene glycol with a molecular weight of 6000 on teflon at 80°C. The sensitivity of the method for the tested compounds varies from $6 \cdot 10^{-3}$ to $1.2 \cdot 10^{-1}$ mg/liter. The reproducibility falls in the range 7 to 18%. It has been shown that the retention time of lower alcohols is dependent on the presence of water in the analytical column. Introduction of water into the column a certain time before the sample is injected improves the alcohol separation. Author

N69-26345# Joint Publications Research Service, Washington, D.C.

EFFECT OF SIMULTANEOUS EXPOSURE TO HYPOXIC HYPOXIA AND HIGH AMBIENT TEMPERATURE ON HUMAN HEAT EXCHANGE

A. N. Azhayev *In its* Space Biol. and Med., vol. 3, no. 1, 1969 14 May 1969 p 175–179 refs (See N69-26327 14-04)
Avail: CFSTI

Heat transfer experiments were conducted on nude subjects at air and wall temperatures of 45° and 50°, and on subjects clad in cotton suits at air and wall temperatures of 60° and 80°. The utilized pressure chambers contained a rarefied atmosphere of 462 mm Hg with an air movement rate of 0.2 to 0.3 m/sec. Relative humidity ranged from 39 percent at lowest temperatures to 15 percent at the highest temperature level. Results showed that subjects exposed to reduced barometric pressure tolerated the higher temperatures better; air rarefaction decreased the total moisture loss by perspiration. G.G.

N69-26388# School of Aerospace Medicine, Brooks AFB, Tex.

ANTICIPATORY STRESS AND FLIGHT STRESS IN F-102 PILOTS Final Report, May 1966–Feb. 1968

George T. Demos, Henry B. Hale, and Edgar W. Williams Nov. 1968 13 p refs
(AD-683271; SAM-TR-68-128) Avail: CFSTI CSCL 6/19

Pilots of F-102 aircraft were studied during a period of preparation for an unaccustomed flying mission as well as during the actual mission by use of a battery of urinary determinations (norepinephrine, epinephrine, 17-hydroxycorticosteroids, urea, phosphorus, magnesium, potassium, sodium, and creatinine). There were four different test circumstances: (a) pretraining briefings dealing with overwater flying and in-flight refueling; (b) the first refueling training flight; (c) the first leg of the actual mission (California to Hawaii); and (d) the second leg of the mission (Hawaii to Guam). In each circumstance there was evidence of endocrinemetabolic hyperactivity, which suggests nonspecific stress. Only during the training flight was there an increase in 17-OHCS excretion and hypophosphaturia (the latter condition suggesting hyperventilation, a known specific response to flight). The fact that flight effects during the second leg of the transoceanic flight were less numerous than during the first leg suggests that an adaptive change occurred. Author (TAB)

N69-26417*# Aztec School of Languages, Inc., Acton, Mass.

ON THE NUMBER OF VISUAL UNITS IN THE MIDDLE PART OF THE RETINA [UEBER DIE ZAHL DER SEHEINHEITEN IM MITTLEREN THEILE DER NETZHAUT]

Theodor Wertheim Washington NASA May 1969 8 p refs Transl. into ENGLISH from Grafes Arch. Ophthalmol. (Berlin), v. 33, 1887 p 137–146
(Contract NASw-1692)
(NASA-TT-F-12104) Avail: CFSTI CSCL 06P

Psychological studies aimed at testing the hypothesis of Claude du Boise–Reymond according to which the retinal cones are to be regarded as optical units are discussed. Both this and the Boise–Reymond's study proceed from the anatomical investigations in which was postulated a connection between the retinal Zapfen (cones) which are found in the eye and the sensory activity of the retina. Author

N69-26450# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

A MATHEMATICAL MODEL FOR GASTROINTESTINAL TRACT DOSIMETRY: APPLICATION TO ADULTS [MODELE MATHEMATIQUE DESTINE A LA DOSIMETRIE DU TRACTUS GASTROINTESTINAL: APPLICATION A L'ADULTE]

Georges Vacca, Jean-Pierre Bazin, and Lucien Karhausen Feb. 1969 67 p refs In FRENCH; ENGLISH summary Prepared jointly with EURATOM
(CEA-R-3707; EUR-4109-f) Avail: CFSTI

A new method is proposed for the computation of the dose delivered to any level of the gastrointestinal tract after ingestion of radioactive substances. The same method is used as that proposed by ICRP. (International Commission of Radiological Protection). The concentration of the radionuclide during the progression of the meal is the central concept of this model. A graph relates the MPC (maximum permissible concentration) with the radioactive halflife of the radionuclide and with any level of the gastrointestinal tract of adults. Soluble and insoluble radionuclides are considered. The case of daughter products is discussed in the appendix. Author (ESRO)

N69-26462# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.

ISOLATION OF AN E. COLI B STRAIN RESISTANT TO SONIC DISINTEGRATION

David Norman and Stephen C. Draher Nov. 1968 19 p refs *Its* Res. Commun. No. 82
(AD-683560) Avail: Issuing Activity CSCL 6/13

A strain of E. coli Bsg surviving intermittent short bursts of lysing sonification during mitotic cycling exhibits a profound resistance to a 15-minute continuous sonification exposure. This level of resistance was noticed in the second and succeeding

generations of survivors. In contrast, E. coli B survivors from direct exposure to 15-minutes of lysing ensonfication evidence no heritable resistance. Reasons for these differences are discussed.
Author (TAB)

N69-26474# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
MIBT AND BACTERIOPHAGE MULTIPLICATION
David Norman and Margaret de la Cruz Dec. 1968 24 p refs
(Its Res. Commun. No. 85
(AD-683563) Avail: Issuing Activity CSCL 6/15

N-methyl isatin-beta-thiosemicarbazone, a known inhibitor of pox-virus in vitro and in vivo, is without effect upon the virulent bacteriophage T4, T4B, T4Bo1, or the temperate phage lambda grown in E. coli. At concentrations which show striking anti-viral activity against the pox-virus in tissue culture, this compound exhibits no activity in the processes of adsorption, penetration, or replication of the bacteriophage studied.
Author (TAB)

N69-26499# Consiglio Nazionale delle Ricerche, Rome (Italy). Istituto Nazionale di Ultracustica O. M. Corbino.
EXPERIMENTAL METHOD FOR ESTIMATING AMBIENT ACOUSTICS [METODO SPERIMENTALE PAR LA VALUTAZIONE ACUSTICA DEGLI AMBIENTI]
I. Barducci, F. Bianchi, and G. Ibba Dec. 1967 39 p In ITALIAN
(INUA-4) Avail: CFSTI

An experimental procedure is investigated that considers the determination of the quality of speech perception in ambient reverberations, by means of an analog technique used in telemetry for evaluating the quality of the transmission. The method consists of determining separately that portion of the total acoustic energy that results in the perception signal, and that part which causes the disturbance in hearing. It is concluded that the speech perception level in ambient reverberations can be experimentally separated from white ambient noise disturbances. Charts and tables showing acoustic levels versus distance and versus reverberations are included.
Transl. by F.O.S.

N69-26505# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
RADIOPROTECTIVE PROPERTIES OF CERTAIN HETEROCYCLIC NITROGENOUS COMPOUNDS ON THE SERUM PROTEINS OF IRRADIATED MICE [PROPRIETES RADIOPROTECTRICES DE CERTAINS HETEROCYCLES AZOTES SUR LES PROTEINES SERIQUES DE SOURIS IRRADIEES]
Theodore Pierotti, Hamid Roushdy, Michel Polverelli, and Marcel Mazza Feb. 1969 26 p refs In FRENCH; ENGLISH summary
(CEA-R-3679) Avail: CFSTI

The results obtained from this study suggest that: (a) the concentration of total serum proteins in mice is very little changed during all the treatments carried out, while protein fractions showed significant alterations, (b) the concentrations of various serum proteins remain almost constant under normal conditions, (c) intraperitoneal administration of imidazole or benzimidazole at the stated doses induces rapid quantitative changes in the serum which disappear in about 3 days after injection, (d) whole-body X-irradiation at 750 röntgens creates slow but progressive and persisting serious changes in a concentration of serum protein fractions which end by death of the animals 8–10 days after irradiation, (e) whole-body X-irradiation of imidazole or benzimidazole protected animals results in quantitative rapid changes in concentration of serum protein fractions for about four days after which a slow but steady restoration begins. The concentration approaches the normal levels towards the 10th day after irradiation, and imidazole and benzimidazole were proved to be good radioprotectors against the effects of radiation on serum protein fractions. Benzimidazole seems to be more effective than imidazole.
Author (ESRO)

N69-26510# Michigan Univ., Ann Arbor. Human Performance Center.
PERCEPTUAL RECOGNITION AS A FUNCTION OF MEANINGFULNESS OF STIMULUS MATERIAL
Gerald M. Reicher Feb. 1968 54 p refs
(Contract AF 49(638)-17)
(AD-683730; AFOSR-69-0488TR; REPT-08773-17-T; TR-7) Avail: CFSTI CSCL 5/10

The study was designed to study the level of information processing at which the observed serial nature of information handling is imposed. While earlier models suggest that raw sensory information is handled serially, evidence is obtained to support the notion of parallel processing of this type of information. One or two single letters, four-letter common words, or four-letter non-words were presented tachistoscopically for three different durations. The stimulus display was immediately followed by a masking field along with two single-letter response alternatives. The task for the subject was to choose the letter which had appeared in the original display and to state his confidence about the correctness of his response. On half of the trials subjects were given the two response alternatives before the stimulus display as well as after it. Performance on single words was clearly better than performance on other types of material. Performance on single words, letters, or non-words was better than performance on two of the same type of material. Giving response alternatives both before the stimulus display and after it caused fairly uniform impairment of performance in all conditions. On the basis of these results, an argument was made for a system which processes raw input information in parallel but handles the resultant highly processed chunks serially.
Author (TAB)

N69-26516# Michigan Univ., Ann Arbor. Human Performance Center.
PICTORIAL AND VERBAL ENCODING IN SHORT-TERM MEMORY
Barbara Gans Tversky Oct. 1968 88 p refs
(Contract AF49(638)-1736)
(AD-683732; AFOSR-69-0491TR; REPT-08773-28-T; TR-10) Avail: CFSTI CSCL 5/10

What is remembered, and the speed of retrieval and systematic errors in retrieval depend on the coding of stimulus information at the time of storage in memory. The study attempted to manipulate the encoding modality of pictorial and verbal material by manipulating the modality of the expected retrieval test (visual or verbal recognition). The stimuli were schematic faces with well-learned nonsense names, constructed so that pictorial similarity correlated negatively with verbal similarity. It was hypothesized that Ss would perform more accurately or faster when encoding modality was the same as the response (test) modality, irrespective of stimulus modality. In Exp. 1, 8 faces were presented on each trial, one was cued, and S attempted to select that one from a set of 2 or 4 faces of names. The data of 2 Ss supported the hypothesis, the data of 2 Ss showed consistent preference for visual coding. In Exp. 2, a single face or name was presented followed by another one; S responded same if they had the same name, different otherwise. Expectancy of test modality was manipulated by having 79% of the second stimuli as faces or 79% as names. Slower reaction times were obtained for all Ss when the second stimulus was the less frequent modality, and RT was less for different responses when the stimuli differed on more than one attribute in the encoding (second-stimulus) modality, regardless of the modality of the first stimulus, or the particular modality of the second stimulus.
Author (TAB)

N69-26518# Flugmedizinisches Institut der Luftwaffe, Fuerstenfeldbruck (West Germany).
DEVELOPMENT, STRUCTURE AND ORGANIZATION OF AIRCRAFT ACCIDENT MEDICINE IN THE BUNDESWEHR [ENTWICKLUNG, AUFBAU UND ORGANIZATION DER FLUGUNFALLMEDIZIN IM RAHMEN DER BUNDESWEHR]
S. Krafft [1968] 27 p refs In GERMAN
Avail: CFSTI

Reviewed is the history of aircraft accident medicine in Germany with emphasis on the Aeromedical Institute of the German Air Force and its accident investigation facilities. Forensic and pathological specialists investigate each aircraft or balloon accident involving injuries of military personnel. Transl. by G.G.

N69-26523 Wisconsin Univ., Madison.
A STUDY OF THE STRUCTURE OF NUCLEOHISTONE AND DNA
Stanley Bram (Ph.D. Thesis) 1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-13621

A study of the basic subunit of the nucleohistone – the 100A fiber – was made employing electron microscopy and small angle x-ray scattering in solution. The nucleohistone (DNH) was prepared from calf thymus. The preparation method represents an improvement in the isolation of DNH and is described in this work. High resolution electron micrographs were taken on sections of embedded pellets of DNH and show the presence of a definite substructure. Nucleohistone was stretched before fixation, and then observed in the electron microscope. It was observed that the diameter decreases from 100 A to a minimum of 25 A at stretch points. Dissert. Abstr.

N69-26685*# Texas Univ., Austin. Applied Research Labs.
APPLIED RESEARCH LABORATORIES Final Report, 1 May 1964–30 Apr. 1968
Lloyd A. Jeffress 12 Dec. 1968 70 p refs
(Order NASA Order R-129; Contracts Nonr-3579(04); NObsr-93124)
(NASA-CR-101170; DRL-TR-68-37) Avail: CFSTI CSCL 06S

A summary of work on visual and auditory signal recognition is presented. The visual studies included: effects of chromatic adaptation on color naming and saturation estimates, ROC curves developed over the course of dark adaptation, and studies of the Bezold–Brücke hue shift. The studies of auditory detection included work on lateralization of sound, on masking level differences (MLDs for tone and narrow-band noise), effect of noise bandwidth on detection of a tonal signal, effect of punishment on performance in a detection task, and a series of studies of electrical and mathematical models of auditory detection. Author

N69-26737# School of Aerospace Medicine, Brooks AFB, Tex.
COMPUTER PROGRAMMING OF AEROSPACE RATIONS Progress Report, Jan. 1967–May 1968
Roy E. Chapin, Mark O. Anway, Paul A. Lozano, and John E. Vanderveen Nov. 1968 18 p refs
(AD-683718; SAM-TR-68-115) Avail: CFSTI CSCL 6/5

Because astronauts onboard space vehicles have not always consumed their food because of its low acceptability and the lesser satisfaction derived from these rations than from a conventional meal, it has become increasingly important to supply aerospace crews with rations that are very palatable as well as nutritionally balanced. A computer program has therefore been developed for this purpose. Foods (44 varieties) are divided into nine groups corresponding to the various courses in a meal. From each group the computer then selects one or two items which, when combined, satisfy the daily nutrient requirements. The computer generates as many as desired of acceptable rations that fall within the nutrient ranges allowed. The crewmember will then select the final rations to be used in his flight, and the computer will recheck his choices for nutritional adequacy. Author (TAB)

N69-26812# Denver Univ., Colo. Dept. of Psychology.
THE EFFECT OF MULTIPLE RESPONSES AND CERTAINTY ESTIMATES ON THE INTEGRATION OF VISUAL INFORMATION
Joseph Halpern and Z. Joseph Ulehla 26 Feb. 1969 24 p refs
(Contract N00014-67-A-0394)
(AD-683363; TR-1) Avail: CFSTI CSCL 5/10

Integration of information was investigated in two experiments that employed a multiple observation, tilt discrimination task. The integration model of signal detection theory generally overestimated the improvement in discrimination resulting from additional observations. Further, probabilistic multiple responses proved detrimental to discrimination. These results differ from earlier findings using different discrimination tasks. Reasons for the differences were discussed. Author (TAB)

N69-26833# Advisory Group for Aerospace Research and Development, Paris (France).
AEROMEDICAL ASPECTS OF TROOP TRANSPORT AND COMBAT READINESS
Oct. 1968 66 p refs Presented at AGARD–NATO Aerospace Med. Panel Symp., Brussels, 10–11 Oct. 1968
(AGARD-CP-40) Avail: CFSTI

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3. RESULTS OF A MEDICAL ENQUIRY ON AIR TRANSPORT OF ITALIAN PARATROOPS P. Rota (Centro di Studi E Ricerche di Med. Aeron. E Spaziale, Rome, Italy) 6 p (See N69-26836 14-04)
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7. MEDICAL ASPECTS OF COMBAT FORCE AIRLIFT DEPLOYMENTS F. Barnum (Mil. Airlift Command, Wash., D.C.) 10 p refs (See N69-26840 14-04)
8. ASSESSMENT OF THERMAL COMFORT IN FLIGHT AND ITS EFFECTS ON PERFORMANCE R. F. Goldman (Army Res. Inst. of Environ. Med.) 14 p refs (See N69-26841 14-04)
9. MILITARY-MEDICAL ASPECTS OF HIGH ALTITUDE R. P. Carson (Army Med. Res. and Nutr. Lab.) 6 p refs (See N69-26842 14-04)

N69-26834# Royal Air Force, Farnborough (England).
TROOP TRANSPORT OPERATIONS
Geoffrey Howard Dhenin *In* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 2 p (See N69-26833 14-04)
Avail: CFSTI

Troop-carrying air operations may be illustrated by reference to RAF air support command, which has long-range passenger

aircraft and short-range/medium-range freighter aircraft. On long-range flights, the troops ride in comfort to airline standards; the only medical problems are fatigue, upset to circadian rhythms, and lack of acclimatization to hot climates. On short-range/medium-range flights, the aircraft are uncomfortable. The medical problems are airsickness and fatigue. Helicopters may accumulate toxic concentrations of carbon monoxide in the cabin if guns are fired. Author

N69-26835# Sanitaetsakademie der Bundeswehr, Munich (West Germany).

EXPERIENCE GAINED FROM THE AIR TRANSPORT OF THE MEDICAL UNITS AMF(L) DURING THE PERIOD 1965 THROUGH 1967

W. K. Thierschmann *In* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 4 p (See N69-26833 14-04)

Avail: CFSTI

The transport of the medical unit equipment by truck and as palletized load, inclusion of one surgical section on each transport aircraft, last minute changes in aircraft availability, relative airlift priorities of the holding station and the mobile field hospital, and troop feeding, briefing, immunization, and acclimatization are discussed. The number of cases in which aeromedical evacuation was affected is listed. The details are supplied on schedule of flights, on transported loads, and on number and types of aircraft used for the air movement of the medical units in the past, along with future requirements. It is noted that medical care for air force combat elements participating in an exercise can be provided by the medical unit only if the operational airfields in the deployment area are not too far removed from the holding station, that is, the AMF(L) deployment airfield. P.A.B.

N69-26836# Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

RESULTS OF A MEDICAL ENQUIRY ON AIR TRANSPORT OF ITALIAN PARATROOPS

Paolo Rota (Ital. Air Force) *IN* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 6 p (See N69-26833 14-04)

Avail: CFSTI

An investigation on Italian paratroops was carried out by filling in individual questionnaires on medical conditions and operating efficiency during a military parachuting mission (flight, parachuting, and ground tasks). From the results, statistically evaluated, some considerations were formulated on the operative efficiency in the different phases of the mission, with respect to previous health status, living habits, weather conditions, and flight experience. Author

N69-26837# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aerospace Medical Research Labs.

BIOLOGICAL RHYTHMS

C. H. Kratochvil *In* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 10 p refs (See N69-26833 14-04)

Avail: CFSTI

The pertinent literature with regard to circadian rhythms is reviewed, and research areas are identified where further effort is required. The problems which specifically relate to the problem of troop transport, and the closely related problem of aeromedical evacuation, are emphasized. The nature of circadian rhythms, the effect of east–west flight vs. west–east flight upon readjustment to the new time zone, the altered response to stress brought about by a shift in time zones, and the methodology of analysis in such studies are discussed. It is pointed out that researchers in the field of sleep studies should work more closely with investigators of circadian rhythms. P.A.B.

N69-26838# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

THE PHYSIOLOGICAL BASIS OF ARTIFICIAL ACCLIMATIZATION TECHNIQUES

J. R. Allen *IN* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 2 p refs (See N69-26833 14-04)

Avail: CFSTI

The value of heat acclimatization for military service in hot countries is repeatedly demonstrated. The underlying physiological changes which characterise the process are now well understood, and methods for their induction by laboratory procedures are described. The absence of acclimatization training from the training schedules of reserve forces based in temperate climates arises from the lack of a truly practical method, but experimental results available do not justify the abandonment of interest in achieving this end. Author

N69-26839# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

THE PREVENTION OF MOTION SICKNESS DURING TROOP TRANSPORT

J. J. Brand *IN* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 2 p refs (See N69-26833 14-04) refs

Avail: CFSTI

When troops are transported for operational purposes by sea or air, symptoms of motion sickness may be expected to occur in a significantly large proportion of them, and this may well impair operational efficiency. Such symptoms may be minimized by the use of effective anti-motion sickness drugs, but medication of this nature can be potentially hazardous if it is not well controlled. Various prophylactic regimes are discussed. Author

N69-26840# Military Airlift Command, Washington, D.C. Office of the Command Surgeon.

MEDICAL ASPECTS OF COMBAT FORCE AIRLIFT DEPLOYMENTS

Ferdinand Barnum *IN* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 10 p refs (See N69-26833 14-04)

Avail: CFSTI

Items covered in predeployment briefing of troops are mentioned. Post deployment comments of the division surgeon involved in the airlift of approximately 10,000 troops are included. The fact that the airlift itself did not, in his opinion, have a detrimental effect upon the troops is important. Reporting that which happened when a rapid decompression occurred at 34,600 feet above sea level in a C-141 carrying 96 troops is emphasized. One troop required hospitalization. All others proceeded on to destination after a delay of approximately 40 hours. Author

N69-26841# Army Research Inst. of Environmental Medicine, Natick, Mass. Military Ergonomics Lab.

ASSESSMENT OF THERMAL COMFORT IN FLIGHT AND ITS EFFECTS ON PERFORMANCE

Ralph F. Goldman *IN* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 14 p refs (See N69-26833 14-04)

Avail: CFSTI

The thermal environmental factors that affect man, i.e., ambient air temperature, humidity or vapor pressure, air motion, and the mean radiant temperature, are reviewed briefly. A number of suggested indices pressure, to integrate these four factors into a single number representative of the combined effect on a man are considered. The effective temperature index (E.T.) is suggested as appropriate for expressing comfortable environments as well as those in which psychological performance can be impaired; an E.T.

of 86°F (30°C) can be used as the threshold for impaired psychomotor performance. The WBGT (wet bulb globe temperature) index, or its non-radiant equivalent the WD index, is recommended for characterizing physiologically stressful environments. The relationship between clothing, level of work, and physiological intolerance at a given WBGT is presented. Some effects of exceeding psychologically and/or physiologically acceptable thresholds are presented in terms of degradation of performance while in such environments. The after effects of having men exposed to such environments during troop transport are considered; residual dehydration is singled out as the most probable cause of subsequent problems. Author

N69-26842# Army Medical Research and Nutrition Lab., Denver, Colo.

MILITARY-MEDICAL ASPECTS OF HIGH ALTITUDE

Richard P. Carson *IN* AGARD Aeromed. Aspects of Troop Transport and Combat Readiness Oct. 1968 6 p refs (See N69-26833 14-04)

Avail: CFSTI

The marked effects of high terrestrial elevations on the body are accentuated by the rapidity of exposure made possible by our present military air transport capabilities. Until some degree of acclimatization is reached toward the end of the first week of exposure, a majority of troops can be expected to manifest symptoms of acute mountain sickness or high altitude pulmonary edema. Combat effectiveness is also reduced by the decremental effect of high altitude on physical and mental performance. These problems are discussed in terms of clinical manifestations, possible pathophysiologic mechanisms, prophylaxis and therapy, and specific performance decrements. The data presented were obtained from studies on healthy volunteers rapidly transported from sea level to the summit of Pikes Peak, Colorado (14,100 ft.). Author

N69-26879# Comitato Nazionale per l' Energia Nucleare, La Spezia (Italy). Laboratorio per lo Studio della Contaminazione Radioattiva del Mare.

STUDIES ON THE RADIOACTIVE CONTAMINATION OF THE SEA Annual Report, 1967

M. Bernhard 1969 72 p refs

(EUR-4244.e; CNEN-RT/BIO-(68)-60) Avail: CFSTI

The Fifth Annual Report of the CNEN-EURATOM is presented. The program calls for studies of the factors which influence the intake, accumulation and loss of radioisotopes by marine organisms. The program is divided into two parts: a), a survey of environmental elements and factors in a sampling area, and b) experiments on the influence of environmental factors on the intake, accumulation and loss of radioisotopes by marine organisms in relation to the data obtained in the survey. The task of carrying out this program has been divided between six groups: CHEMISTRY, BOTANY, ZOOPLANKTON, MICROBIOLOGY, FISHERIES, BIOLOGY and SPECIAL DEVELOPMENTS. An account is given of the results obtained by these groups in 1967. Author

N69-26880# Joint Publications Research Service, Washington, D.C.

EFFECT OF TETRODOTOXIN ON ELECTRIC ACTIVITY AND CONTRACTIONS OF MYOCARDIAL CELLS

R. S. Orlov et al 19 May 1969 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 185, no. 1, 1969 p 221–224

(JPRS-48059) Avail: CFSTI

A study was made of the influence of the frequency and number of preceding excitation waves on the transmembrane action potential (t.a.p.) parameters and contractions of myocardial cells under the action of tetrodotoxin (TTX). Isolated perfused frog ventricles were the object of investigation. Glass microelectrodes filled with a 2.5 M solution of KCl were used to record intracellular activity. Contractions were recorded by means of a tensometric amplifier. The TTX was applied in concentrations of 2.5×10^{-6}, 5×10^{-8}, and 10^{-7} g/ml. Results show that TTX decreases the rate of depolarization, the amplitude and duration of the t.a.p., as well as the amplitude and duration of contractions in frog ventricle myocardial fibers. This effect of TTX is apparently due to the suppression of sodium permeability, the same as in skeletal muscle, and mainly affects the transient sodium current, which is significantly reduced, whereas the late potassium current remains unchanged. K.R.G.

N69-27032# Michigan Univ., Ann Arbor. Human Performance Center.

THE EFFECTS OF SIMILARITY ON VERY-SHORT-TERM MEMORY UNDER CONDITIONS OF MAXIMAL INFORMATION PROCESSING DEMANDS

Elizabeth Ligon May 1968 104 p refs

(Contract AF 49(638)-1736)

(AD-683731; AFOSR-69-0489TR; REPT-08773-19-T; TR-8) Avail: CFSTI CSCL 5/10

Two experiments were conducted to assess the role of similarity in very-short-term memory under conditions of stimulus presentation which assured perception but permitted little or no rehearsal of the to-be-recalled items. Sequences of 12 alphanumeric items were presented on a Bins-Vue screen at a rate of 3/sec to the subject who read aloud each item as he perceived it. The presentation of each sequence was followed by a recall test which presented one item from the sequence as a probe stimulus and required recall of the item or items which had immediately succeeded the probe in the sequence. Within a sequence both the number of items similar to the to-be-recalled unit (TBRU) and the proximity of these items to the TBRU were systematically varied. Striking effects of similarity on performance were obtained in both experiments. Performance decreased as a function of the number and proximity of prior and subsequent items similar to the TBRU. The results offer general support for associative type models of short-term memory and argue against models which assume that retention from short-term memory, primary memory, or a buffer-like store is invariant with respect to the similarity between the surrounding items and the item to be retrieved. Author (TAB

N69-27033# Pittsburgh Univ., Pa. Dept. of Pharmacology.

PERCEPTUAL SPACE OF ORGANISMS AND AUTOMATA Final Report, 1 Oct. 1966–31 Dec. 1968

Gerhard Werner, Barry L. Whitsel, and Hershel Sacks 31 Dec. 1968 27 p refs

(Contract DADA17-67-C-7032)

(AD-683606; FR-8) Avail: CFSTI CSCL 6/16

A detailed study of the organization of the neural pathways transmitting tactile and kinesthetic signals from the body periphery to the somatic sensory area I in the cerebral cortex of primates identified certain patterns of receptive fields in the body periphery, and of neurons in the cerebral cortex, which have the attributes of open sets of elements and form topologies. The mapping between the body periphery and its cortical image is shown to be a homeomorphism. In addition, the cortical map has properties which characterize it as a non-orientable surface. The continuity of the mapping from cortex to body periphery and the topology of the latter insure the existence of a lifting function capable of generating the cortical image that corresponds to a peripheral stimulus configuration. The implication is that the tactile-kinesthetic body representation in the cerebral cortex possesses properties which are not inherent in the raw data originating from the peripheral sense organs themselves; and that continuity and three-dimensionality of the space of haptic perception is a

consequence of the characteristics of the neural mapping process which links body periphery and central sensory representation. The operational principles that underlie certain sensory representations in organisms suggest ways of designing automata with comparable environmental sensing capabilities. Author (TAB)

N69-27042# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
FATAL INJURIES RESULTING FROM EXTREME WATER IMPACT
Richard G. Snyder and Clyde C. Snow Sep. 1968 10 p refs
(AM-68-19) Avail: Issuing Activity

Increased overwater flight has resulted in an increase in both military ejections and civil crash landings in water, 78 general aviation water accidents occurring in 1965. The objective of this study was to determine mechanisms of gross trauma in non-penetrating fatal water impact. The method involved analysis of necropsy data on 169 fatal jumps from the Golden Gate Bridge. The most common mechanism of injury was crushing of the thoracic cage with resultant bilateral rib fractures and penetration of the vital organs (85.2 percent). Lung lacerations, ruptured livers, brain injury, and drowning were most frequent. In 17 cases, no skeletal fractures were found. Eight individuals, apparently relatively uninjured by the impact subsequently drowned. These data reinforce previous work indicating human tolerance in water impact close to 116 ft/sec (33.53 m/sec) velocity, and body orientation is critical. Author

N69-27139# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BIOGRAPHY OF THE INTELLECT
B. F. Sergeev 16 Feb. 1968 42 p Transl. into ENGLISH of the Publ. "Biografiya Intellekta" Moscow, Izd. Znaniye, 1967 p 1-37
(AD-683945; FTD-HT-23-81-68) Avail: CFSTI CSCL 5/10

The document skims through the development of intelligent life on earth, discusses conditioned-reflex activity in some detail, with emphasis on temporary connections and the second signal system (human speech), and generally traces the development of the central nervous system. Author (TAB)

N69-27161# Aeronautical Research Council (Gt. Brit.)
A METHOD OF MEASURING THE IMPEDANCE OF THE HUMAN RESPIRATORY SYSTEM AT MODERATE FREQUENCIES
K. R. Maslen and G. F. Rowlands 1969 56 p refs Supersedes RAE-TR-66296; ARC-30004
(ARC-CP-1031; RAE-TR-66296; ARC-30004) Copyright. Avail: CFSTI; HMSO 10s 6d

The stability of aircrew breathing equipment depends not only on the stability of the oxygen regulator, but also on the impedance of the system it feeds, which includes the user's respiratory system. A method of measuring the human respiratory impedance, in the range 5-90 c/s, by comparing oscillating pressures at two points in an external reference system, is described; and results are given for nose and mouth, heavy and light, breathing. The effect of altitude, and of increased external resistance to breathing are briefly discussed. The importance of correct representation of man's impedance in dynamic testing of oxygen equipment is illustrated by reference to the characteristics of a present-day simulator and system, and an improved type of simulator is suggested. Author

N69-27185# Joint Publications Research Service, Washington, D.C.
CHANGES OF INDICES OF EXTERNAL RESPIRATION, GAS EXCHANGE AND ENERGY EXPENDITURE OF A HUMAN SUBJECT DURING WEIGHTLESSNESS
I. I. Kas'yan et al 28 Mar. 1969 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 1, 1969 p 20-29
(JPRS-47735) Avail: CFSTI

In three series of experiments the indices of external respiration, gas exchange and energy expenditure were investigated with special small-dimension spiroanemometers under conditions of weightlessness and hypodynamia. The study showed that the intensity of gas exchange and the level of energy expenditure of subjects during brief weightlessness considerably exceeded the indices obtained in a horizontal flight. During hypodynamia a 30-40 percent reduction in the level of metabolic processes was observed in the subjects, while the reduction was 5-10 percent when measured physical work was performed. Author

N69-27186# Army Biological Labs., Fort Detrick, Md.
BIOLOGY AND FLIGHTS TO OUTER SPACE
N. N. Zhukov-Verezhnikov Jul. 1968 12 p Transl. into ENGLISH from Nauka i Zhizn (USSR), v. 29, no. 9, 1962 p 15-20
(AD-678922; Trans-1103) Avail: CFSTI CSCL 6/3

The article deals with the following topics: Biological conditions of flights to the nearest planets: Planet microorganisms and the prevention of their penetration to the earth; Biological conditions for distant space flights at speeds approaching that of light; and the possibility of biological verification of the relativity theory. TAB

N69-27208# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEM FOR THE AUTOMATIC MAINTENANCE OF A COMPLEX OF VITALLY IMPORTANT INDICES OF THE INTERNAL MEDIUM
A. N. Medelyanovskii 23 Feb. 1968 17 p Transl. into ENGLISH from Med. Tekhn. (USSR), no. 2, 1967 p 9-18
(AD-683173; FTD-MT-24-374-67) Avail: CFSTI CSCL 6/12

Development is reported of an automatic system capable of fairly long-term support of the vital activity of an organism deprived of various major organs or systems simultaneously. Prosthetic versions of various major organs currently exist (artificial lungs, artificial kidneys, artificial heart, and the like). The authors proposed to combine such major organ prostheses into a bioregulated system capable of sustaining vital activity. This entailed the creation of a complex control system, biologically regulated (i.e. responsive to changes in the vital indices of the organism itself), which would maintain various interdependent indices (blood pressure, blood levels of oxygen, carbon dioxide, and various essential or toxic substances) within preset, biologically optimum ranges. The work was done at the Central Institute of Hematology and Blood Transfusion and the All-Union Scientific Research Institute of Medical Instrumentation in Moscow, under the general supervision of Academician V. V. Parin. The system developed consisted of an isomorphic model of the natural regulatory system of the body, possessing receptors (natural or artificial sensors) and effectors (major organ prostheses) combined into a complex feedback network. Author (TAB)

N69-27261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SLEEP AND THE TRANSITION STATES OF MAN UNDER CONDITIONS OF SPACE FLIGHT
T. N. Krupina et al 1 Aug. 1968 9 p Transl. into ENGLISH from Vestn. Akad. Nauk SSR (Moscow), no. 4, 1968 p 104-106
(AD-683102; FTD-HT-23-579-68) Avail: CFSTI CSCL 6/19

The problem of sleep is discussed with regard to the maintaining of good working capacity in space flight. An All-Union Symposium on this subject was held at the Academy of Sciences which dealt with the mechanism of sleep and ways of controlling it. Author (TAB)

N69-27301 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany). Sektor Kernchemie.
NUCLEAR CHEMISTRY COMPENDIUM. PART 4: PRINCIPLES OF RADIATION PROTECTION AND DOSIMETRY [KERNCHEMISCHES KOMPENDIUM. TEIL 4: GRUNDLAGEN DES STRAHLENSCHUTZES UND DER DOSIMETRIE]
K. E. Zimen, H. W. Levi, P. Moeller, and J. Hacke Dec. 1968 96 p refs In GERMAN
(HMI-B-78-Pt-4; B-C 43) Copyright. Avail: Issuing Activity

A detailed review is presented of the following: (1) interaction of radiation with matter, including determination of the radiation field and the interactions of charged particles, X-rays, gamma rays, and neutrons; (2) concepts and units of dosimetry, including energy doses, the Bragg-Gray principle, ion doses at radiation equilibrium, and dose equivalence; (3) radiation tolerance of humans and maximum permissible concentration of radioactive materials; (4) calculation and measurement of alpha, beta, gamma, and neutron radiation; (5) shielding and shielding calculations; and (6) incorporation and estimation of radionuclides in the human body. A selected bibliography is included. Transl. by K.W.

N69-27316# School of Aerospace Medicine, Brooks AFB, Tex.
FIFTY YEARS OF AEROSPACE MEDICINE: ITS EVOLUTION SINCE THE FOUNDING OF THE UNITED STATES AIR FORCE SCHOOL OF AEROSPACE MEDICINE IN JANUARY 1918
Green Peyton 1968 273 p refs *Its* AFSC Historical Publ. Ser. No. 67-180
(AD-682521) Avail: CFSTI CSCL 5/4

A history of aerospace medicine in the United States is presented covering the period from 1918 to 1968. TAB

N69-27455# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMIC AND STATIC PROBLEMS OF THE THEORY OF DEFORMABLE SHELLS OF THE BLOOD VESSEL SYSTEM
A. S. Vol'mir et al 1969 11 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 5, no. 1, 1969 p 3-10 Presented at 3d All-Union Congr. on Theoret. and Appl. Mech., Moscow, 27 Jan.-1 Feb. 1968
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Mathematical analyses on the biophysics of blood circulation, including space biology aspects, are briefly reviewed. Specific investigations discussed are: (1) Korotkov sounds in arterial pressure measurement; (2) pulse wave propagation in arteries; (3) artery behavior under nonstationary dynamic loading; and (4) equilibrium modes of erythrocyte shells. E. C.

N69-27487*# Hazelton Labs., Falls Church, Va.
USE OF THE ENZYME HEXOKINASE FOR THE REDUCTION OF INHERENT LIGHT LEVELS
Emmett W. Chappelle inventor (to NASA) Issued 8 Apr. 1969 (Filed 27 Jul. 1966) 4 p Cl. 195-68
(NASA-Case-XGS-5533; US-Patent-3,437,560; US-Patent-Appl-SN-568346) Avail: US Patent Office CSCL 06A

A method is described of minimizing the inherent light activity of residual adenosinetriphosphate (ATP) in luciferase compositions to make such compositions more suitable for life detection studies, such as determinations of sterile conditions, life presence on planets, etc. The light stabilization technique is practiced by the addition of controlled amounts of both hexokinase and glucose to any luciferase compositions and allowing sufficient time to elapse to insure the complete binding of all of the residual ATP to the glucose to give glucose-6-phosphate and adenosine diphosphate (ADP). The hexokinase is trans-phosphorylase which catalyzes this reaction which involved the transfer of the terminal phosphate of the ATP to the glucose. So that the resultant luciferase composition be still light reactive, it is essential that the hexokinase be in high state of purity before addition, particularly with regard to other enzymes such myokinase, 3-phosphoglycerickinase and pyruvate kinase. NASA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-26259*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THE EQUIPOTENTIAL SPACE SUIT DESIGN CONCEPT AND ITS APPLICATION TO A SPACE SUIT ELBOW JOINT
Donald E. Barthlome Washington May 1969 43 p ref
(NASA-TN-D-5221) Avail: CFSTI CSCL 06K

Space-suit design studies indicate that a high operational feasibility exists for a concept involving a nonconstant-volume space-suit elbow joint, a joint-assist mechanism, and a space-suit pressure stabilizer. The space-suit pressure stabilizer serves to limit pressure changes within the joint to ± 0.05 psi (0.035 N/cm^2). The joint-assist mechanism, or joint assist, is a modified constant-force spring mounted on a soft space-suit joint. The cross section of the spring has been altered so that most of the energy required to bend the joint is provided by the joint assist. The joint and stabilizer, both of which exhibit relatively high degrees of elasticity, store most of this energy and return it to the joint assist as the joint and stabilizer return to their initial configurations. Therefore, if friction is neglected, the joint, joint assist, and stabilizer constitute a system with a total potential energy that remains constant (regardless of the angle of bend) and equal to the initial potential energy given to the assist during installation on the joint. Test results show that the maximum bending moment required by the joint was reduced from 1.40 lbf-ft (1.90 N-m) without the assist to 0.10 lbf-ft (0.14 N-m) with the assist, a reduction of 14 to 1. Author

N69-26276*# Aztec School of Languages, Inc., Maynard, Mass.
ACOUSTIC DYNAMICS OF MACHINES
I. I. Artobolevskiy et al Washington NASA Apr. 1969 14 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), no. 11, Nov. 1968 p 50-59
(Contract NASw-1692)
(NASA-TT-F-12214) Avail: CFSTI CSCL 06F

Methods used in decreasing or eliminating vibrations in mechanisms and machines are reviewed, as are the characteristic strengths of individual units and complexes. It is shown that acoustic dynamics of machines and the effect of noises on man and machine must be studied together. Author

N69-26329# Joint Publications Research Service, Washington, D.C.
YEAR-LONG MEDICAL AND ENGINEERING EXPERIMENT IN A GROUND LIFE-SUPPORT SYSTEM
A. I. Burnazyan et al *In its* Space Biol. and Med., Vol. 3, No. 1, 1969 14 May 1969 p 11-26 refs (See N69-26327 14-04)
Avail: CFSTI

Reactions of human physiological systems and the entire body to prolonged restrictions in a pressurized cabin were studied in a year long ground life support experiment. Results of

clinical–physiological observations on human responses to the pressurized restricted area under specific conditions of water and oxygen cycling showed: (1) reduced pulse and respiration rates; (2) decreased body weight; (3) decreased acidity of gastric juice but increased lipase and enterokinase; (4) considerable changes in intestine autoflora; and (5) adequate mental and physical work capacity. G.G.

N69-26347*# Martin Co., Denver, Colo.
INTEGRATED MANEUVERING AND LIFE SUPPORT SYSTEM SIMULATION Final Report
A. E. Wudell, L. M. Hunt, and D. M. Adams Apr. 1969 126 p refs
(Contract NAS9-9109)
(NASA-CR-99656; MCR-69-184) Avail: CFSTI CSCL 06K

A study effort was made on the comparison, through simulation, of the performance of four configurations on an integrated maneuvering and life support system (IMLSS). Variations in angular and rotational acceleration levels comprised the differences between configurations. Direct control in both attitude and translation was used. Data were collected on the performance of each configuration for one test subject flying a sequence of four space tasks. The tasks included: moving inspection, translating around corner, workshop excursion, and LM-CSM transfer. C.G. shifts and inertia dyadic changes were also investigated. The test subject was suspended in the gimbaled head of the six degree of freedom servo-driven moving base simulator. The simulation technique involves computation of the problem dynamics on a hybrid computer which then determines the commands for the moving base. Signals from the hand controller mockups are used in the hybrid program to introduce the thrust histories. Author

N69-26348# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
19 May 1969 20 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 185, no. 1, 1969 p 16–19; 24–27; 58–60
(JPRS-48058) Avail: CFSTI

CONTENTS:

1. GAME VERSION OF THE OPTIMAL HALT PROBLEM Ye. B. Dynkin p 1–7 refs (See N69-26349 14-19)

2. TWO METHODS FOR FINDING THE EQUILIBRIUM POINTS OF CONCAVE n-PLAYER GAMES S. I. Zukhovitskiy et al p 8–13 refs (See N69-26350 14-19)

3. FUNCTIONAL EQUIVALENCE OF FINITE-STATE AUTOMATA A. A. Letichevskiy p 14–17 refs (See N69-26351 14-08)

N69-26443# Wissenschaftliche Gesellschaft fuer Luft- und Raumfahrt, Brunswick (West Germany).
REPORT ON THE FOURTH MEETING OF THE WGLR SCIENTIFIC COMMITTEE FOR HUMAN ENGINEERING [BERICHT UEBER DIE 4. SITZUNG DES WGLR-FACHAUSSCHUSSES FUER ANTHROPOTECHNIK]
Feb. 1968 74 p refs In GERMAN; ENGLISH summary Conf. held at Munich, 3 Jun. 1966
(DLR-Mitt-68-03) Avail: CFSTI

CONTENTS:

1. THE PROBLEM OF THE REFERENCE SYSTEM AND ITS MEANING FOR TRANSMISSION OF INFORMATION TO THE PILOT G. W. Radl (Technische Univ.) p 6–40 refs (See N69-26444 14-05)

2. PERSONALITY FACTORS AND SPATIAL ORIENTATION G. W. Radl (Technische Univ.) p 41–52 refs (See N69-26445 14-05)

3. METHODS FOR MEASURING THE EYE MOVEMENTS OF PILOTS P. Hammer (Technische Univ.) p 53–75 refs (See N69-26446 14-05)

N69-26444# Technische Univ., Berlin (West Germany). Institut für Flugführung und Luftverkehr.
THE PROBLEM OF THE REFERENCE SYSTEM AND ITS MEANING FOR TRANSMISSION OF INFORMATION TO THE PILOT [DAS PROBLEM DES BEZUGSSYSTEMS UND SEINE BEDEUTUNG FUER DIE INFORMATIONSUEBERTRAGUNG AUF DEN PILOTEN]
G. W. Radl *In* WGLR Rept. on the 4th Meeting of the WGLR Sci. Comm. for Human Eng. Feb. 1968 p 6–40 refs In GERMAN (See N69-26443 14-05)
Avail: CFSTI

The human part of the man-machine system in aircraft guidance is discussed. The perception of signs by the pilot is explained and the different stimuli are analyzed. The layout of onboard indicating instruments and especially the artificial horizon best suitable for transmission of information to the pilot are discussed from both a psychological and a human engineering point of view; some reflections are presented on pilot training and the ability of pilots to change over from one system of reference to another. ESRO

N69-26445# Technische Univ., Berlin (West Germany). Institut für Flugführung und Luftverkehr.
PERSONALITY FACTORS AND SPATIAL ORIENTATION [PERSOENLICHKEITSFAKTOREN BEI DER ORIENTIERUNG IM RAUM]
G. W. Radl *In* WGLR Rept. on the 4th Meeting of the WGLR Sci. Comm. for Human Eng. Feb. 1968 p 41–52 refs In GERMAN (See N69-26443 15-05)
Avail: CFSTI

Personality and psychological aspects of human engineering tests concerning spatial orientation of pilots are presented with the aim to facilitate the diagnosis of spatial orientation capability of personnel. Four personality factors are analyzed which are of importance for spatial orientation. ESRO

N69-26446# Technische Univ., Berlin (West Germany). Institut für Flugführung und Luftverkehr.
METHODS FOR MEASURING THE EYE MOVEMENTS OF PILOTS [VERFAHREN ZUR MESSUNG DER AUGENBEWEGUNGEN VON PILOTEN]
P. Hammer *In* WGLR Rept. on the 4th Meeting of the WGLR Sci. Comm. for Human Eng. Feb. 1968 p 53–75 refs In GERMAN (See N69-26443 15-05)
Avail: CFSTI

Methods that can be used to measure eye movements of aircraft pilots are listed and discussed. Such measurements serve the purpose of determining the field of vision e.g. in aircraft instrument reading. It is shown that only the photographic recording method using a T.V. or film camera fixed on the head of the pilot gives correct results, because it takes into account head movement as well. All measurements performed with the pilot head held in a fixed position are unrealistic. ESRO

N69-26447*# AiResearch Mfg. Co., Los Angeles, Calif.
MAN'S CAPABILITY FOR SELF-LOCOMOTION ON THE MOON. PHASE 2: BUNGEE SIMULATOR EVALUATION

A. Camacho, W. Price, K. Walther, and W. Robertson May 1969 63 p
(Contract NAS1-7053)
(NASA-CR-66768; Rept-69-5103) Avail: CFSTI CSCL 05E

A bungee-cord suspension system used for the simulation of lunar gravity was designed, fabricated and dynamically tested to provide data on the validity of the 1/6-g simulation. Two test subjects walked at 2 and 4 KPH, loped at 6 and 8 KPH and ran at 6 and 8 KPH on a hard surface at 1/6 g in the bungee-cord simulator. Metabolic costs were measured during a preexercise rest period, a 14-min exercise period, and a 6-min post exercise period. Dynamic testing of the simulator during jumping events with constant accelerative force input showed errors of 15.5 percent to 20.2 percent in total time aloft and −21.2 percent to −27.4 percent in maximum height achieved when compared to ideal time and height responses. Metabolic rates were similar to those reported in Phase I of this study. Differences between the bungee-cord simulator and the simulators used during Phase I could not be discriminated. Author

N69-26455*# Aztec School of Languages, Inc., Acton, Mass.
PERCEPTION OF SPACE AND TIME IN OUTER SPACE
A. A. Leonov et al Washington NASA May 1969 111 p refs Transl. into ENGLISH of the book "Vospriyatiye Prostranstva i Vremeni v Kosmose" Moscow, Nauka Press, 1968 p 1–115
(Contract NASw-1692)
(NASA-TT-F-545) Avail: CFSTI CSCL 06S

The characteristic dynamics of spacecraft flight are explained as well as the role of astronauts in the "man-spacecraft" system. The authors describe how the conditions of existence and the psychophysiological mechanisms of perception of space and time outside the earth change during a flight in outer space. The effect of weightlessness, prolonged isolation in a small area, emotional tension, and other factors of space flight on human perception of time are explained. Author

N69-26492 University of Southern Calif., Los Angeles.
ON THE ADAPTIVE BEHAVIOR OF THE HUMAN OPERATOR IN RESPONSE TO A SUDDEN CHANGE IN THE CONTROL SITUATION
Anil Vinayak Phatak (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17038

The synthesis of a mathematical model is presented which describes the adaptive behavior of a trained human operator in response to sudden changes in plant dynamics and transient disturbances. The operator performs closed loop manual control in a compensatory tracking situation and is trained to adapt to a finite number of alternative transitions in plant dynamics. These plant changes are so chosen as to result in overall system instability unless the operator rapidly modifies his tracking strategy to that required for the new dynamics. The example studied in this investigation is that of an aircraft whose stability augmentation may fail. Based on experimental data for human operator response to various types of failures, the operator adaptive strategy is partitioned into four distinct phases: prefailure steady state control, detection of failure or change in plant dynamics, identification of postfailure plant dynamics and appropriate modification of his control strategy, and postfailure steady state control. Dissert. Abstr.

N69-26507# Systems Research Labs., Inc., San Antonio, Tex.
FURTHER PHYSIOLOGIC RESEARCH ON HUMAN TUMBLING
John G. Fletcher Brooks AFB, Tex. School of Aerospace Med. Oct. 1969 81 p refs
(Contract AF 41(609)-2897)
(AD-683717; SAM-TR-68-1) Avail: CFSTI CSCL 5/9

Twelve tumbling problems, ranging from impaired performance to water immersion deconditioning, were investigated by using an important training and physiologic research tool—the all-attitude air-bearing research and training simulator (ARTS). It was shown that among healthy persons there is a wide spectrum in tolerance to tumbling. Evidence was obtained that men may be disoriented by tumbling, yet show no symptoms of motion sickness, and vice versa. Other investigations which are described include: complex patterns of rotation and tumbling, respiratory effects, phase shifts at different rpms, subject capability to perform a simulated flying movement during turning, body position effects, and the ability of some subjects to withstand continuous tumbling for at least 1 hour. Author (TAB)

N69-26508# Air Force Systems Command, Lackland AFB, Tex. Air Force Human Resources Lab.
SELECTION OF FOREIGN STUDENTS FOR TRAINING IN THE UNITED STATES AIR FORCE
Cecil J. Mullins, James B. Keeth, and Larry D. Riederich Nov. 1968 26 p refs
(AD-683725; AFHRL-TR-68-111) Avail: CFSTI CSCL 5/9

A group of tests has been used to predict success in pilot and technical training for groups of foreign nationals trained in the United States. In addition to previous flying experience two types of tests were tried: paper-and-pencil and performance tests, hopefully of low cultural loading. For those going into pilot training without previous pilot experience, one performance test, rudder control, gave the highest prediction, with one of the paper-and-pencil tests adding significantly. For technical training, five paper-and-pencil tests showed low but significant prediction. It is noted that three of the paper-and-pencil tests, used alone, are significantly valid for pilot training and can make considerable improvement in pilot trainee selection procedures. Author (TAB)

N69-26576# Ohio State Univ., Columbus.
EVALUATION OF ANGLE OF ATTACK INSTRUMENTATION IN THE TRAINING OF STUDENT PILOTS TO PRIVATE PILOT CERTIFICATE Final Report
Julius H. Gandelman Washington Federal Aviation Admin. Aug. 1968 147 p refs
(Contract FA-67-WA-1810)
(AD-683359; FAA-DS-68-19) Avail: Issuing Activity CSCL 5/9

An evaluation of the effectiveness of angle-of-attack instrumentation in the training of student pilots to private pilot certification was conducted by comparing flight performances and other related measures between a control group and an experimental group. The experimental group differed only in that they would use angle-of-attack information in addition to airspeed. Author (TAB)

N69-26598# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL ALGORITHM FOR THE RECOGNITION OF CERTAIN SEQUENCES OF IMAGES
V. A. Kovaleskii 18 Oct. 1968 20 p refs Transl. into ENGLISH from Kibern. Dok., Akad. Nauk SSR (Moscow), no. 4, 1967 p 75–80
(AD-683536; FTD-HT-23-698-68) Avail: CFSTI CSCL 6/4

The problem of the recognition of pattern sequences is considered with respect to a line of typewritten text; since in conventional typographical text the spaces between letters are particularly difficult to distinguish and a line of text cannot be subdivided into discrete recognizable signs, the problem of recognition of the entire line must be considered. The recognition of an entire line by comparing it with all the possible standard lines of text is an infeasible problem. Nevertheless, the problem of recognition of a line of typewritten text can be formulated and solved on the

basis of certain assumptions concerning the properties of the line image. In this connection it is shown an exact solution of the problem of locating the standard line that is most similar (correlates) with the line image that must be recognized, requires a comparatively small volume of calculations and memory capacity. As in the case of any other pattern recognition problem this can be accomplished by first constructing a mathematical model describing all the possible images presented for recognition i.e., in this case all the possible images representing lines of typewritten text. TAB

N69-28707# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
A HISTOGRAM DISPLAY SYSTEM (BIO TV) FOR PHYSIOLOGICAL SIGNAL MONITORING Final Report, Oct. 1966–Nov. 1967
Adolf R. Marko Nov. 1968 21 p refs
(AD-683338; AMRL-TR-68-2) Avail: CFSTI CSCL 6/12

A system, BIO-TV, for display of physiological signals on unmodified television sets has been investigated. The study resulted in the development of a prototype converter that accepts four physiological signals and produces a standard video signal. Four vertical graph bars indicate by their lengths, heart rate, respiration rate, body and skin temperature, and are displayed on one or more television screens. Two horizontal limit lines are also displayed that may be set to indicate high and low safety limits of the measurements. The design concept is flexible and may be adapted to a variety of medical monitoring requirements. The main application of this system is as a convenient, quick-look, safety monitor of patients or subjects in medical research experiments. Design considerations, circuit, and construction details are outlined in the report. Author (TAB)

N69-27090# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
FUNCTIONAL EXPLORATION OF THE THYROID GLAND OF RATS ON THE THIRD DAY AFTER A SPINAL SECTION AT HIGH LEVEL [EXPLORATION FONCTIONNELLE DE LA THYROIDE CHEZ LE RAT AU TROISIEME JOUR APRES SECTION MEDULLAIRE HAUTE]
Claudine Agnius-Delord, Sylvain Caine, Maurice Tanche, and Renaud Rinaldi Feb. 1969 22 p refs In FRENCH; ENGLISH summary
(CEA-R-3738) Avail: CFSTI

Studies have been carried out on the influence of a spinal section at high level on the thyroid fixation, this latter being measured after an injection of iodine–131 carried out 72 h after the section with animals having two different diets, the one with iodine, the other without iodine. In this case, and for all animals, the results show an increase of thyroid fixation with regard to the control animals. However this increase is not significant; only the difference between the rates of fixation for the injections carried out 15 min and 24 h after section and these measured 48 h and 72 h after section is significant. The hormonal discharge always decreased significantly with regard to the controls, as was found for the animals treated 15 min, 24 h and 48 h after section. The thyroid fixation and the hormonal discharge of rats subjected to a simple laminectomy at level where the spinal sections have also been studied. The results did not show significant differences between the control animals and the animals subjected to such an operation. Author (ESRO)

N69-27149*# Hayes International Corp., Huntsville, Ala.
SPACECRAFT STERILIZATION TRAINING MANUAL
Elsebath A. Quinn Jan. 1969 127 p refs
(Contract NAS8-20083)
(NASA-CR-61253) Avail: CFSTI CSCL 06M

Sterilization training programs for shop personnel were initiated at Marshall Space Flight Center in order to train these personnel to make a greater contribution to spacecraft sterilization at the fabrication and assembly levels. This manual covers the material presented in these training courses. The manual is designed to provide a basic understanding of the microbiological implications in spacecraft sterilization and to present applicable scientific information in layman's terms. A glossary, review questions, and laboratory exercises are included. Author

N69-27226# Federal Aviation Administration, Washington, D.C.
THE MAN IN THE MAINTENANCE RELIABILITY SYSTEM
Dec. 1968 299 p refs Presented at 4th Ann. FAA Maintenance Symp., Oklahoma City, 3–5 Dec. 1968
(AD-683759) Avail: CFSTI CSCL 5/9

This publication is a compilation of papers presented on aviation maintenance personnel. The papers indicate what is being done to keep the man in the maintenance reliability system current in his vocation and also forecast future trends and needs. Author (TAB)

N69-27286*# Garrett Corp., Los Angeles, Calif.
A STUDY OF ASTRONAUTS' EXTRAVEHICULAR WORK CAPABILITIES IN WEIGHTLESS CONDITIONS
E. C. Wortz, W. Schreck, W. Robertson, G. Lamb, and L. Browne Washington NASA May 1969 247 p
(Contract NAS1-7571)
(NASA-CR-1334) Avail: CFSTI CSCL 05E

Exploratory experiments were conducted on methods of erection and assembly of large modules, transportation of cargo modules, and crew rescue during weightless simulation by neutral buoyancy techniques. A formal experiment was conducted on four typical restraint systems during the performance of various tasks with varying work envelopes. Data were collected on energy expenditures, reactive loads, and performance times. Conclusions are drawn about various aspects of extravehicular activity work and the efficacy of restraint systems. Author

N69-27438# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AEROSOL BEHAVIOR IN HIGH PRESSURE ENVIRONMENTS Final Report, 1 Mar. 1968–28 Feb. 1969
Robert A. Gussman Feb. 1969 161 p refs
(Contract N00014-68-C-0271)
(AD-683794; BBN-1770) Avail: CFSTI CSCL 6/11

The purpose of this study was to elucidate hazards to personnel arising from aerosols in high pressure helium-oxygen atmospheres utilized in deep submergence vessels. Aerosol properties of sedimentation, diffusion, agglomeration, electrification, and the slip correction factor have been extrapolated to pressures of 500 psia. The effects of the atmosphere upon aerosol filtration, electrostatic deposition, condensation and evaporation have been considered. Experiments have been performed to verify the possibility of maintaining a corona discharge in the given atmosphere for both positive and negative applied potentials. The deposition patterns of aerosols within the lung have been considered via the application of a deposition model to a range of particle sizes and pressures. The possibility of significantly increased respiratory deposition is evident. Author (TAB)

N69-27486# Federal Aviation Administration, Oklahoma City, Okla. Office of Aerospace Medicine.
A COMPARISON OF EFFECTS OF PERIPHERAL VISION CUES ON PILOT PERFORMANCE DURING INSTRUMENT FLIGHT IN DISSIMILAR AIRCRAFT SIMULATORS
A. Howard Hasbrook Sep. 1968 6 p refs
(AM-68-22) Avail: CFSTI

Pilot response to peripheral vision cues relating to aircraft bank angle was studied during instrument flight in two simulators

representing (1) a conventional, medium weight, piston engine airliner, and (2) a heavy, jet engine, sweptwing transport. There was no statistically significant difference found between pilot performance in the dissimilar type aircraft, suggesting that peripheral vision cues may be equally useful regardless of differences in size, weight and flight characteristics of fixed wing aircraft. Author

N69-27577*# Aztec School of Languages, Inc., Acton, Mass.
ELECTROMEDICAL APPARATUS: PRINCIPLES OF OPERATION, INSTALLATION, AND USE
N. M. Liventsev Washington NASA May 1969 430 p Transl. into ENGLISH of the book "Elektromeditsinskaya Apparatura: Printsip Deystviya, Ustroystvo, Ekspluatatsiya" Moscow, Meditsina Press, 1964
(Contract NASw-1692)
(NASA-TT-F-523) Avail: CFSTI CSCL 06B

This expanded and updated edition covers the following: (1) phototherapeutic appartus, including the use of optical radiation, lamps for infrared and photothermal radiation, and lamps for ultraviolet radiation; (2) electrocardiographs powered by battery and line voltage, and low-frequency amplifiers; (3) dc and low-frequency electrotherapeutic apparatus; (4) electrotherapeutic apparatus using high-frequency currents; (5) apparatus for ultrasonic therapy; and (6) organization and operation of electrical phototherapeutic departments. K.W.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-26171# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTISEIZE AND ANTIWEAR ADDITIVES BASED ON DIETHERDITHIOPHOSPHORIC ACIDS DERIVED FROM ALKYL AND ARYL ESTERS OF GLYCERINE ALPHA-MONOCHLOROHYDRIN
A. M. Kuliev and Z. A. Alizade 15 Nov. 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Neft Gaz (USSR), v. 10, no. 7, 1967 p 53–55
(AD-683969; FTD-HT-23-1014-68) Avail: CFSTI CSCL 11/8

Dietherdithiophosphoric acids with the general formula (ROCH2(CHCl)CHO)2PSSH were interacted with ethylene oxide and epichlorohydrin and the resultant compounds tested as antiseize and antiwear additives in an attempt to develop organic compounds combining at least three active elements in a single molecule. Analysis of the products of interaction between dietherdithiophosphoric acids and ethylene oxide shows that they are very close in composition to trietherdithiophosphoric acids. The resultant trietherdithiophosphoric acids were tested as antiseize and antiwear additives in AK-15 oil on a four-ball tetrahedral friction machine with ShKh-6 steel balls. The results show that both additives have high antiseize and antiwear properties with about equal numerical values for the generalized wear index. TAB

N69-26196# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMERS CONTAINING FERROCENE NUCLEI
Jui-Te Ma, Poa-Chen Yeh, Chin-Chaeng Lu, and Lien-Fen Wu 26 Aug. 1968 11 p refs Transl. into ENGLISH from Kao Fen Tzu Tuang Hsun (Peking), v. 6, no. 2, 1964 p 148–152
(AD-683112; FTD-HT-23-1640-67) Avail: CFSTI CSCL 7/3

Vinyl ferrocene (I), acryloyl ferrocene (ferrocenyl vinyl ketone) (II), trans-cinnamyl ferrocene (III), and furylacryloyl ferrocene (IV) were synthesized, among which (IV) was unknown in literature. (I) and (II) could be homopolymerized and copolymerized with styrene and methyl methacrylate using ABN as initiator, (III) and (IV) could not be homopolymerized, but could be copolymerized with styrene or methyl methacrylate. Author (TAB)

N69-26203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE EFFECT OF GAMMA-RADIATION ON THE PROCESS OF OXIDATION OF POLYETHYLENE AS DETERMINED BY INFRARED SPECTROSCOPY
B. N. Narzullaev et al 8 Nov. 1968 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk. Tadzh. SSR (Stalinabad), v. 10, no. 3, 1967 p 21–24
(AD-683534, FTD-HT-23-1103-68) Avail: CFSTI CSCL 7/5

Polyethylene 100 microns thick was irradiated using a 60Co source to a dose of 10 to the 5th power to 4 x 10 to the 5th power rads. The sample was kept under vacuum for 20 days and exposed to the air for 5 days. The ir spectrum was detd. and analyzed, and graphical representations illustrating the dependence of the optical density of the bands at 1720, 1465, 1375, and 965/cm on the dose are shown. A mechanism to account for the processes of degradation and loss of crystallinity is suggested. Author (TAB)

N69-26220# Naval Ordnance Lab., White Oak, Md.
A SURVEY OF RECENT LITERATURE ON CHEMILUMINESCENCE AND FLUORESCENCE IN SOLUTION
Eleonore G. Kayser and Thomas N. Hall 11 Oct. 1968 123 p refs
(AD-683673; NOLTR-68-71) Avail: CFSTI CSCL 7/5

This report represents a literature survey of the structural factors affecting direct and sensitized visible chemiluminescence in solution. Compilations of the quantitative and qualitative data for the important classes of direct chemiluminescent reaction are given. These classes include: luminol, lophine, lucigenin - their analogs and derivatives. Other parameters affecting the efficiency and lifetimes of chemiluminescent reactions covered in this report include: fluorescer concentration, solvent, catalyst and oxidizer. The effect of structure on the quantum efficiency and spectral distribution of fluorescence is a subject which can be studied independently of the chemiluminescence phenomena. The report gives some quantitative and qualitative data concerning these structural effects. Author (TAB)

N69-26226# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CAPILLARY COLUMNS FOR CHROMATOGRAPHY—EXPERIMENTS AND APPLICATIONS
Ching-Chun Ting, Wei-Hsu Tang, and Pao-Lin Chu 23 Aug. 1968 18 p refs Transl. into ENGLISH from Hua Hsueh Tung Pao (Peiping), no. 2, 1965 p 50–56
(AD-683109; FTD-HT-23-1133-67) Avail: CFSTI CSCL 7/4

The paper gives some experiments in capillary gas liquid chromatography. Some details are provided on the experiments, and detailed drawings of the apparatus used in the experiments are given. The experiments show that it was possible to use an 82-meter glass capillary to get 129 chromatographic peaks in 90 minutes from the fractional distillation of a petroleum sample. TAB

N69-26238*# Techtran Corp., Glen Burnie, Md.
POINTS OF FUSION AND DECOMPOSITION IN THE POTASSIUM CHLORATE-SODIUM CHLORATE SYSTEM [PUNTOS DE FUSION Y DE DESCOMPOSICION EN EL SISTEMA POTASSIUM CHLORATE-SODIUM CHLORATE]
A. Perez Vitoria Washington NASA Apr. 1969 12 p refs
Transl. into ENGLISH from Anales Real Soc. Espan. Fis. Quim (Madrid), v. 27, 1929 p 787–797
(Contract NASw-1695)
(NASA-TT-F-12204) Avail: CFSTI CSCL 07D

Points of fusion and decomposition of potassium chlorate and sodium chlorate and their mixtures are determined by pyrolysis. The mutual influence of the salts on fusion points is studied. Mixtures of the two chlorates are not recommended for production of oxygen. Author

N69-26250 Kansas State Univ., Manhatten.
TRACE OXIRANE DETERMINATIONS AND REACTION GAS CHROMATOGRAPHY. 1: OXIDES OF NITROGEN. 2: PRIMARY AMINES
Harold Edward Mishmash (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17521

Trace quantities of alpha-epoxides were determined using a spectrophotometric technique. The oxirane is reacted with sulfuric acid to form the glycol. This is then cleaved with periodate forming the carbonyls and iodate. The change in periodate-iodate concentration is measured with a cadmium iodide-starch reagent forming the characteristic blue color. A gas chromatographic procedure is utilized to study the interaction of nitric oxide, nitrogen dioxide, and nitrous oxide with lead dioxide. Utilizing the information obtained on the nitrogen oxides–lead dioxide interactions, and coupling this to an existing method for the primary amino group, a modification of this method was developed. The primary amino sample is reacted with nitrous acid and the evolved nitrogen-nitrogen oxides mixture is passed through the reactive and chromatographic column. The oxides of nitrogen are removed with PbO_2 while the nitrogen peak is eluted and recorded. Dissert. Abstr.

N69-26257*# Yale Univ., New Haven, Conn. Dept. of Physics.
A AND M PHYSICAL AND OPTICAL OBSERVATIONAL SPECTROSCOPY AND BREAKDOWN Interim Technical Report, 1 Jul.–31 Dec. 1968
Vernon W. Hughes, Willis E. Lamb, Jr., and George J. Schulz 15 Jan. 1969 8 p
(Contract F44620-69-C-0018; ARPA Order 1011)
(AD-683702; AFOSR-69-0310TR) Avail: CFSTI CSCL 7/4

The paper is an interim report on: electron time-of-flight spectroscopy in the 1 to 1/100 eV energy range, research on dissociation of molecular hydrogen leading to formation of metastable hydrogen atoms, and electron energy losses in molecular gases at low energy. TAB

N69-26260*# National Aeronautics and Space Administration, Washington, D.C.
CATALYTIC DECOMPOSITION OF CHLORITES. 2: DECOMPOSITION OF SODIUM CHLORITE IN THE PRESENCE OF COBALT AND NICKEL HYDROXIDES [KATALITICHESKOYE RAZLOZHENIYE KHLORITOV. 2: RAZLOZHENIYE KHLORITA NATRIYA V PRISUTSTVII GIDROOKISEY NIKELYA I KOBAL'TA]
A. Yu. Prokopchik et al May 1969 27 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai: Ser. C (Vilna), v. 1, no. 24, 1961 p 133–142
(NASA-TT-F12208) Avail: CFSTI CSCL 07D

This paper presents data on catalytic decomposition of $NaClO_2$ in alkaline solutions by the action of nickel and cobalt hydroxides. It was ascertained that sodium chlorite in the presence of nickel and cobalt hydroxides decomposes with the formation of chlorate and chloride, i.e. it disproportionates. Oxygen decomposition of chlorite is not observed. The rate of disproportionation of sodium chlorite increases with rise of temperature, quantity of catalyst and initial concentration of decomposing chlorite. Reduction of pH of the solution also accelerates the reaction of chlorite decomposition, whereas upon increase of pH of the solution to about 13 the activity of nickel hydroxide decreases markedly while cobalt hydroxide is practically completely deactivated. In the presence of nickel hydroxide the decomposition of sodium chloride proceeds close to first fractional order, whereas in the presence of cobalt hydroxide it occurs distinctly according to first order. Author

N69-26266*# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
DETERMINATION OF IRON, NICKEL AND CHROMIUM IN THE MASURCA SIMULATION RODS [DOSAGE DU FER, DU NICKEL ET DU CHROME DANS LES REGLETTES DE SIMULATION DE MASURCA]
Michèle Brigaudeau and Simone Piardet Mar. 1969 45 p refs
In FRENCH; ENGLISH summary
(CEA-R-3760) Avail: CFSTI

A method has been developed for determining the iron, nickel and chromium content of sintered ternary oxide rods designed to simulate structural elements in the reactor Masurca. During this work a calculation was made of the conditional constant of the Fe-EDTA complex in a formic buffer solution, and of that of the Ni-EDTA complex in an ammonical buffer. From these two values it appears that it is not possible to carry out the iron and nickel determinations with a standard EDTA solution when these two elements are simultaneously present. Consequently, separation of the Fe and Ni is carried out in 8N HCl solution on an anion exchange resin. Each element is then dosed by titricolorimetry. Chromium is determined by the same technique without prior separation. The reproducibility of the method has been calculated for each of the three elements. The relative accuracy is 0.58 per cent for the iron, 1.41 per cent for the nickel, and 0.39 per cent for the chromium. Author (ESRO)

N69-26274 Seton Hall Univ., South Orange, N.J.
FARADAIC RECTIFICATION AT THE DROPPING MERCURY ELECTRODE WITH OPERATIONAL AMPLIFIER INSTRUMENTATION
John Shu-Chi Chiang (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-17539

A general study of Faradaic rectification was made with reversible electrode processes. Results indicate that the magnitude, but not the sign, of the Faradaic rectification current obtained with the present technique is described adequately by a theoretical equation. However, the current–concentration relationship deviates from the predicted linearity because, with this instrument, a large alternating signal is required to give a well-defined wave. Experimental results indicate that this technique provides exceptional resolution of mixed reducible ions. A mixture of indium and cadmium with half-step potentials differing by 48 millivolts is easily resolved; by alternating current polarography, only partial resolution was achieved. Dissert. Abstr.

N69-26280 Texas Technological Coll., Lubbock.
A STUDY OF OXIME CHELATES OF RHENIUM
Phillip Warren Grayson (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-17546

A variety of 2-pyridylketoximes was prepared and their complexes with rhenium were studied. The effects on the rhenium complexes were studied as the 2-pyridylketoxime structures were changed. It was found that the molar absorptivity of the rhenium 2-pyridylketoxime complexes varies greatly with varying oxime structure. Strong electron donating groups and phenyl groups attached to the oxime carbon produce the most sensitive complexing reagents for rhenium. The acid strength (pKa) of the oximes also changes with structure, but a general correlation between pKa of the 2-pyridylketoxime and the molar absorptivity of the rhenium oxime complex was not possible. However, a correlation was found to exist between pKa and the molar absorptivity if the structures being changed were of the same general type (e.g., alkyl changed to another alkyl or phenyl changed to another phenyl). Dissert. Abstr.

N69-26318# California Univ., Santa Barbara. Dept. of Chemistry.
ENVIRONMENTAL EFFECTS ON PHOSPHORESCENCE. 6: MATRIX SITE EFFECTS FOR TRIPHENYLENE
Henry W. Offen and David E. Hein 25 Feb. 1969 21 p refs
(Contract N00014-67-A-0120)
(AD-683699; TR-16) Avail: CFSTI CSCL 7/4

The phosphorescence lifetime and spectra of triphenylene are studied in different matrices at 77K and as a function of increasing pressure (0-30 kbar). The magnitude of the pressure shift of the spectra and the pressure coefficient of the lifetime depend upon the size of the molecules comprising the solvent cage. This difference in pressure response is attributed to the preponderance of repulsive interactions between highly symmetric triphenylene and smaller solvent molecules under pressure. Author (TAB)

N69-26324*# Westinghouse Research Labs., Pittsburgh, Pa.
SEPARATOR DEVELOPMENT FOR A HEAT STERILIZABLE BATTERY Quarterly Report, 1 Apr.–30 Jun. 1968
L. C. Scala and G. D. Dixon 31 Jul. 1968 10 p Prepared for JPL
(Contracts NAS7-100; JPL-951525)
(NASA-CR-101102; QR-8) Avail: CFSTI CSCL 07D

It is now possible continuously to dip-coat Webril support tape which is 12 inches wide. Long runs were made producing separator material having satisfactory resistivity values and hydroxyl ion diffusion rates. Several alternative supporting tapes were evaluated. Flame absorption spectroscopic analysis indicated that zincate ion diffusion was very slow. The addition of free zirconia to the sterilizing mixture reduced the weight loss and decreased the resistivity of most separators. Author

N69-26378# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE COMPLEXES MF_6, nNaF (M = U, W, Mo) [ETUDE DES COMPLEXES MF_6, nNaF (M = U, W, Mo)]
Ginette Beenard, Albert-José Dianoux, Olivier Hartmanshenn, Hubert Marquet-Ellis, and Nguyen-Hoang-Nghi Feb. 1969 44 p refs In FRENCH; ENGLISH summary
(CEA-R-3732) Avail: CFSTI

A study of the complexes MF_6, nNaF (with M = uranium, tungsten and molybdenum) has been carried out using analytical and gravimetric methods, DTA, magnetic property measurements and infrared absorption. The results show that the octahedral MF_6 unit in these complexes keeps its locally and partially covalent nature, but it propably has a lower type of symmetry than in the gas Author (ESRO)

N69-26379# Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).
APPLICATION OF GAMMA ABSORPTIOMETRY TO THE ANALYSIS OF URANIUM IN SOLUTIONS [APPLICATION DE L'ABSORPTIOMETRIE GAMMA A L'ANALYSE DE L'URANIUM DANS DES SOLUTIONS]
Michel Lavaud Feb. 1969 26 p refs In FRENCH; ENGLISH summary
(CEA-R-3708) Avail: CFSTI

A gamma-ray absorptiometric apparatus for the determination of uranium or plutonium in solution was studied and built. Results obtained by the method and possible developments are given. Author (ESRO)

N69-26382 Texas Technological Coll., Lubbock.
SOLID STATE THERMAL AND PHOTOCHEMICAL REACTION KINETICS
Eugene Lynn Simmons (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17552

An equation describing the rate of the photochemical reaction of a solid powdered sample was derived on the basis of a modified Beer-Lambert equation. Reflection coefficients were used to account for diffusely reflected radiation and the Lambert cosine law was used to account for spectrally reflected radiation. The resulting rate equation could be used to determine the quantum yield of a photochemical reaction. The derived equation was tested experimentally by studying the photochemical reaction of potassium tris (oxalato) manganate (III) 3-hydrate. The equation was found to be valid for this reaction. The quantum yield was two. The compound studied undergoes the same oxidation-reduction reaction thermally and photochemically. Therefore, the thermal reaction kinetics were studied to compare with the photochemical reaction kinetics. Magnetic susceptibility measurements were used to follow the extent of the thermal reaction. Dissert. Abstr.

N69-26383 Alfred Univ., N.Y. College of Ceramics.
AN INVESTIGATION OF THE NONSTEADY STATE BEHAVIOR OF ELECTRODES UNDER PERIODIC RECTANGULAR CURRENTS
Alan Arthur Schneider (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-16620

Periodic rectangular currents are used to polarize hydrogen-oxygen fuel cells and silver-silver chloride electrodes. Measurements with the latter system are taken at 20°C, 50°C, and 80°C; the concentration of the potassium chloride electrolyte is 0.01M, chosen so that diffusion polarization would be limiting at high current densities. The resulting average polarization (the average taken over an entire period) is used to characterize the behavior of these electrochemical systems under nonsteady state. It is found that on increasing the pulsing frequency, the average electrode polarization magnitude first decreases to a value below that which would occur if the cell were loaded with a steady current of a magnitude equal to the average pulsed current; with further increases in frequency, the average polarization begins to increase. The point at which this increase begins is below 50Hz. Dissert. Abstr.

N69-26401# Minnesota Univ., Minneapolis. Dept. of Chemistry.
FLUORESCENCE QUENCHING VIA INTRAMOLECULAR PROTON TRANSFER
W. R. Ware, P. R. Shukla, P. J. Sullivan, and R. V. Bremplis 10 Mar. 1969 18 p refs Prepared in cooperation with San Diego State College
(Contract N00014-67-A-0113)
(AD-683797; TR-4) Avail: CFSTI CSCL 7/5

Studies of fluorescence quenching via intramolecular proton transfer are described for the systems 3-hydroxy-2-naphthoic acid in several solvents. It has been found that bases which promote the proton transfer in nonpolar solvents function by parallel static and dynamic mechanisms and that the mechanism proposed by Hirota, which assumed rapid establishment of the proton transfer equilibrium during the lifetime of the excited state, is not correct. The mechanisms of both the static and the dynamic processes

have been investigated by using fluorescence lifetime techniques and by making steady-state fluorescence quenching measurements. The results for various solvents and at various temperatures are reported for the acid, its methyl ester, and the corresponding methoxy derivative. Author (TAB)

N69-26414# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

CRYSTALLOGRAPHIC STUDY OF THE INORGANIC PART OF THE FERRITIN MOLECULE [ETUDE CRISTALLOGRAPHIQUE DE LA PARTIE MINERALE DE LA MOLECULE DE FERRITINE]

Jean-Jacques Lawrence Jan. 1969 15 p refs In FRENCH; ENGLISH summary

(CEA-R-3690) Avail: CFSTI

Diffraction data from a ferritin core, essentially made of an iron hydroxyde, suggests a hexagonal unit cell (a = 11.79 Å; c = 9.90 Å). This product cannot be identified with any known iron hydroxide but its diffraction diagram shows some similarities with that of δ FeOOH. Author (ESRO)

N69-26423# Naval Ordnance Lab., White Oak, Md.

ON THE EQUATION OF STATE OF COMPRESSED LIQUIDS AND SOLIDS

Sigmund J. Jacobs 15 Dec. 1968 24 p refs

(AD-683290; NOLTR-68-214) Avail: CFSTI CSCL 20/13

The work of van der Waals on gases and Mie and Gruneisen on solids produce equations of state of the form p = G(v,T) NkT/v + po (v). Many more recent theoretical studies have led to results expressible in the same form. Despite this fact it has been almost a universal fad to describe equations of state through the dimensionless compressibility factor, F(v,T) = pv/NkT instead. This paper shows that much useful information is discarded when the latter form is used. An analysis of po and G(v,T) for the Lennard-Jones Devonshire free volume theory and the equation of state results obtained by the Monte Carlo (molecular dynamics) method has shown that both studies lead to essentially the Mie-Gruneisen equation at high density when the temperature is low enough. At higher temperatures for high density and for all temperatures at lower densities the two theories come close to the usual theories for dense fluids. The functional relations for G(v,T) are sufficiently simple to be replaced by analytic functions to facilitate application of the theories to practical problems. It appears that empirical improvements on the original theories can also be made on the basis of new knowledge about the states under consideration. For illustration an analytic fit to the Monte Carlo result for a Lennard-Jones 6-12 potential is presented. A breakdown of Lennard-Jones result for the second virial coefficient is appended. Author (TAB)

N69-26429# Olin Mathieson Chemical Corp., New Haven, Conn. Chemicals Group.

PREPARATION OF BORON-SUBSTITUTED CARBORANES BY BORON INSERTION REACTIONS

John S. Roscoe, Santad Kongpricha, and Stelvio Papetti Mar. 1969 10 p refs

(Contract Nonr-3395(00))

(AD-683668; TR-42) Avail: CFSTI CSCL 7/2

The boron insertion reaction of Hawthorne was employed in preparing 3-fluoro-, 3-bromo- and 3-diphenylamino-o-carborane. This reaction was further extended to the m-carborane system to produce 2-fluoro- and 2-diphenylamino-m-carborane. 3-fluoro-o-carborane could be isomerized at 400C to a mixture of 2-fluoro- and 4-fluoro-m-carborane, which was separated by liquid chromatography on a basic alumina column. Likewise, 3-diphenylamino-o-carborane was isomerized, and the 2-diphenylamino- and 4-diphenylamino-m-carborane isomers were separated by the same technique. Author (TAB)

N69-26475# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.

ELECTRON DETACHMENT FROM H(-) BY ELECTRON IMPACT

Oleg Bely and Sanford B. Schwartz Nov. 1968 14 p refs *Its* Res. Commun. No. 79

(AD-683557) Avail: Issing Activity CSCL 7/4

The electron detachment from H(-) by electron impact is computed by several partial wave expansion methods. Results are compared with experiment. Author (TAB)

N69-26476# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.

LIFETIMES OF CASCADE-FREE TRANSITIONS IN IONS OF Ar, Cl and S

George M. Lawrence Dec. 1968 22 p refs *Its* Res. Commun. No. 87

(AD-683565) Avail: Issuing Activity CSCL 7/4

Radiative lifetimes of vacuum uv multiplets classified as (3s2 3p m - 3s3p (M+1)) in ArII, ArIII, ArIV, SII, and CIII, measured with a pulsed electron technique, are found to be cascade-free with lifetimes 13 to 55 times larger than given by central field calculations. The discrepancy is attributed to configuration mixing with terms of the 3s3p(m-1)3d configurations. Author (TAB)

N69-26493 Cornell Univ., Ithaca, N.Y.

OPTICAL ROTATORY PROPERTIES OF BIOPOLYMERS

John N. Vournakis (Ph.D. Thesis) 1968 159 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-15741

Both experimental and theoretical methods were used to study the optical rotatory properties of a series of nucleic acids and poly-α-amino acids. The optical rotatory dispersion of a variety of ribo and deoxyribo nucleotides (ApApCp, oligomers of both ribo- and deoxyribo- adenylic acid, and alanine and tyrosine transfer RNA) were measured. Information was obtained about the conformation and the stability of these molecules, and about the physical interactions involved in their structure. It was found that neighbor-neighbor base stacking interactions involving electrostatic forces are important factors in maintaining the conformation of single-stranded polyribonucleotides in solution at low temperature. Both base stacking and intramolecular hydrogen bonding are involved in the stability of the low temperature form of the transfer RNA. Dissert. Abstr.

N69-26495 Texas Univ., Austin.

MORE DATA AND A MODEL FOR METAL AMMONIA SOLUTIONS

Rondon Lee Schroeder (Ph.D. Thesis) 1968 74 p

Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-16134

The electrical conductivity of cesium-ammonia solutions was measured over the concentration range 6 to 100 mole percent metal (MPM) and over the temperature range 110 to 300°K. From the data of conductivity vs temperature, the liquidus of the phase diagram was determined. Conductivities of lithium-ammonia solutions near 20 MPM and above 240°K were measured. A model is proposed to explain the compressibility, conductivity, and thermopower of concentrated metal-ammonia solutions. The conductivity of $Cs\text{-}NH_3$ does not differ much from the other alkali metal ammonia solutions up to 16 MPM. From 16 to 100 MPM the conductivity rises much less steeply than that for $Li\text{-}NH_3$ solutions. The temperature coefficient of conductivity is positive up to about 30 MPM and there changes sign. The liquidus has a eutectic at 16 MPM and 130°K. Dissert. Abstr.

N69-26512# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
LOW-TEMPERATURE THERMODYNAMIC EFFECTS OF THE SPIN-LATTICE COUPLING IN SOLID ORTHO-HYDROGEN
L. C. Bartel, R. D. Etters, and J. C. Raich Dec. 1968 22 p refs Prepared in cooperation with Sandia Labs. *Its* Res. Commun. No. 89
(AD-683567) Avail: Issuing Activity

A model of the coupled spin-phonon system in solid ortho-hydrogen at very low temperatures is given. This model is solved exactly. The results are found to be in qualitative agreement with experiment. Author (TAB)

N69-26519# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
ELECTRIC AND MAGNETIC PROPERTIES OF POLYMERIC ORGANIC SEMICONDUCTORS
N. R. Byrd, F. D. Kleist, and D. N. Stamires Nov. 1968 10 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co. *Its* Res. Commun. No. 77
(AD-683555) Avail: Issuing Activity CSCL 20/12

The electrical conductivity and ESR absorption have been measured in the poly(phenylacetylene) and the three derivatives poly(p-aminophenylacetylene), poly(p-formamidophenylacetyle) and poly(p-nitrophenylacetylene). TAB

N69-26521 Polytechnic Inst. of Brooklyn, N.Y.
THE APPROACH TO QUASI-EQUILIBRIUM OF A HIGH-CURRENT DENSITY, PULSED GLOW DISCHARGE IN HELIUM AND HELIUM HYDROGEN MIXTURES
Frank Allario (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-16231

The results of a study on high-current density, pulsed glow discharges in helium and helium-hydrogen mixtures are presented. This study traces the temporal development of several parameters of the pulsed discharges in the interval of time between the application of the voltage pulse until a condition of quasi-equilibrium is attained late in the discharge pulse. These discharges, of 1.3 microsecond duration, are sustained in 2.5 centimeter diameter Pyrex tubes with interelectrode gaps variable between 10 and 40 centimeters. The pressure range runs from 0.50 to 5.0 torr. As the discharges approach the condition of quasi-equilibrium, current densities of the order of 15 amperes per cm^2 are maintained, without any emission lines of the electrode material appearing in the spectrum of the discharge. Dissert. Abstr.

N69-26555# Massachusetts Inst. of Tech., Cambridge.
INVESTIGATION OF THE INFLUENCE OF THE STRUCTURE AND COMPOSITION OF CLEAN SOLID SURFACES ON THE NATURE AND BEHAVIOR OF SOLID–FLUID INTERFACES Final Report, 29 Jan. 1964–31 Jul. 1968
P. L. Bruyn 17 Feb. 1969 7 p refs
(Contract DA-31-124-ARO(D)-187)
(AD-683601; AROD-4684.5-MC) Avail: CFSTI CSCL 7/4

This paper discusses the interface separating a metal oxide from an aqueous electrolyte solution. Two experimental techniques were applied: adsorption measurements through potentiometric titrations of oxide suspensions and electrical capacity measurements on single crystals. The oxides selected for detailed study were rutile (TiO2) and zincite (ZnO). A result of this investigation is a new insight into the nature of oxide/aqueous solution interfaces. An important accomplishment is the formulation of a thermodynamic treatment of adsorption at the oxide-solution interface. Author (TAB)

N69-26561# Atomic Energy Commission Research Establishment, Riso (Denmark) Health Physics Dept.
ENVIRONMENTAL RADIOACTIVITY IN DENMARK IN 1967
A. Aarkrog and J. Lippert Jun. 1968 88 p refs
(Riso-180)
Avail: CFSTI

The present report deals with the measurement of fallout radioactivity in Denmark in 1967. Sr-90 was determined in samples from all over the country of precipitation, soil, ground water, sea water, grass, dried milk, fresh milk, grain, bread, potatoes, vegetables, fruit, total diet, drinking water, and human bone. Furthermore Sr-90 was determined in local samples of air, rain water, grass, sea plants, fish meat, and human milk. Cs-137 was determined in milk, grain products, potatoes, vegetables, fruit, total diet, meat, and human milk samples, and Cs-137 was measured by wholebody counting in persons from a control group at RisoA1. Estimates of the mean contents of radiostrontium and radiocaesium in the human diet in Denmark in 1967 are given. The gg-background was measured regularly at locations around RisoA1, at ten of the State experimental farms and in an area in Sealand and one in Jutland where future nuclear power plants might be located. Finally the report includes, as previously, regular surveys of environmental samples from the RisoA1 area. Author (ESRO)

N69-26563 Kansas Univ., Lawrence.
OXIDATIVE DEGRADATION MECHANISMS OF ELECTROGENERATED TRANSIENT SYSTEMS
Donald Wayne Leedy (Ph.D. Thesis) 1968 218 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-17414

The anodic electrochemistry of several selected diphenylamine systems has been investigated in detail by electroanalytical methods. In particular, cyclic voltammetry, reverse current chronopotentiometry, and electron paramagnetic resonance (epr) spectroscopy have been valuable in ascertaining overall reaction mechanisms. Emphasis has been placed upon the elucidation of follow-up chemical reactions occurring after the initial electron-transfer process in acetone-aqueous acid solutions. The relative rates of these reactions and correlations with structural parameters calculated from simple Hückel molecular orbital (HMO) theory are discussed. The systems studied include phenyl substituted N-phenyl-p-aminophenols, N-phanyl-p-anisidines, N-phenyl-p-phenylenediamines and several N-methylated derivatives of the above. The overall oxidation process results in the formation of p-benzoquinone and substituted anilines for all the systems studied. Dissert. Abstr.

N69-26564 Polytechnic Inst. of Brooklyn, N.Y.
THERMODYNAMIC PROPERTIES OF THE NICKEL-CADMIUM ALKALINE AND LEAD-LEAD OXIDE ACID CELLS
Stanley Milton Caulder (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-16235

An investigation of the nickel-cadmium electrochemical cell reaction using calorimetry, differential thermal analysis (DTA), thermogravimetric analysis (TGA) and X-ray analysis has shown that the previously believed independence of the electrochemical cell reaction on electrolyte type is not completely valid. The enthalpy change for the nickel-cadmium cell cycled in 7.9N KOH was found to be 33.2 Kcal. $equiv.^{-1}$ while that of the same cell cycled in 6.3N LiOH was 37.7 Kcal $equiv.^{-1}$. This enthalpy difference is attributed to a difference in the degree of hydration of the active material which is believed to be associated with the alkali metal cation. DTA and TGA results were consistent with the calorimetric results which indicated that the active material cycled in LiOH was hydrated to a lesser degree than that cycled in KOH. Dissert. Abstr.

N69-26580# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONFORMATIONS OF CYCLOPENTADIENYL DERIVATIVES OF TRANSITION METALS
Valerii G. Dashevskii, Zigmunt L. Kaluski, and Aleksandr I. Kasigorodskii 7 Nov. 1968 15 p refs Transl. into ENGLISH from Rocznicki Chemii (Poland), v. 41, no. 3, 1967 p 559–565
(AD-683991; FTD-MT-24-388-68) Avail: CFSTI CSCL 7/4

Conformations of cyclopentadienyl derivatives of transition elements were calculated. The barriers of internal rotations of cyclopentadienyl rings were defined and variety of conformations of ferrocene derivatives was explained. Conformations of some overcrowded metallocene molecules were discussed.
Author (TAB)

N69-26591# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
ELECTRON IMPACT IONIZATION OF POSITIVE IONS AND ATOMS USING A COAXIAL BEAM TECHNIQUE
P. Mahadevan Dec. 1968 31 p refs *Its* Res. Commun. No. 84
(AD-683562) Avail: Issuing Activity CSCL 7/4

Using a beam superposition technique, the ionization of positive ions and atoms of atmospheric gases is studied. The method of superposition in the present instance, involves the flight along identical linear paths of confined beams of electrons and the relatively heavier particles such as the ions or atoms of oxygen and nitrogen. The large difference in velocity between the electrons and the heavier particles and the long common path they traverse together, enhance the probability of collisions between them leading to ionization. Preliminary results of ionization of N2, N2(+), O2(+), He(+) and A are presented and discussed.
Author (TAB)

N69-26603# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
LOW-ENERGY (1 EV TO 100 EV) CHARGE TRANSFER CROSS-SECTION MEASUREMENTS FOR NOBLE GAS ION COLLISIONS WITH GASES
P. Mahadevan and G. D. Magnuson Oct. 1968 40 p refs Prepared in cooperation with Va. Univ. *Its* Res. Commun. No. 76
(AD-683554; Douglas Paper-5097) Avail: Issuing Activity CSCL 7/4

Cross sections for charge transfer between positive ions and atoms and molecules have been measured in the low-energy range (1 to 100 eV), using direct-current techniques for slow-product ion detection. The electrode configuration adopted is designed to discriminate against elastically scattered primary particles. Resonant symmetric systems such as He(+) + N2 and He(+) + O2, respectively, have been investigated. Cross-section functions for the symmetric cases conform to an expression of the form: square root of sigma = a - blnE. Other reactions studied include Ar(+) in N2 and H2 and the inverse reactions Ar(+) + He and He(+) + Ar, respectively. Results are compared with values in the existing literature.
Author (TAB)

N69-26624 Cornell Univ., Ithaca, N.Y.
CATION DIFFUSION IN FLUORITE CRYSTALS
Michael Edward Baker (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-16732

The diffusion of the radioactive tracers Ca^{45}, Sr^{89} and Ba^{133} in CaF_2, SrF_2 and BaF_2 crystals has been measured from 900°C to within 75°C of their melting points. Above 1050°C, the concentration profiles indicate a volume diffusion mechanism. The Arrhenius plots of the diffusivities were analyzed to determine the activation energy, Q, and D_o, for each diffusion system. Using ionic conductivity results, calculations of the energy to form Schottky trios, and the results of this study, the lattice disorder and diffusion defect mechanism were discussed. It seems likely that Schottky disorder becomes important at high temperatures in all three crystals. Self diffusion appears to proveed by a single vacancy mechanism in all three crystals. The motion of Ba^{133} in CaF_2 and SrF_2 may occur by a vacancy pair mechanism. The implications of this work on ionic conductivity at high temperatures are also discussed.
Dissert. Abstr.

N69-26626 Boston Univ., Mass.
FERROELECTRICS AND THE MOSSBAUER EFFECT
Richard Oman Bell (Ph.D. Thesis) 1968 239 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-18143

This dissertation is a study of the application of the Mössbauer effect to ferroelectrics and a study of the general dielectric properties of perovskites. The Mössbauer absorption spectra of Fe^{57} was interpreted in the compounds Sr $(TaFe)_{1/2}$ O_3 and Pb $(NbFe)_{1/2}$ O_3 and the solid solution $SrTiO_3$ + 1.15 Sr $(TaFe)_{1/2}$ O_3 (STFT) on the basis that the type of ion on the B site of the ABO_3 perovskite structure is random. The principal contribution to the electric field gradient at the ion was shown to be due to the polarization of the oxygen which occurs when it is located in between two different charge species. Slight distortions from cubicity contribute to the EFG. A discontinuous change of approximately 0.04 mm/sec is observed at the Curie temperature of Pb $(NbFe)_{1/2}$ O_3, and of 0.03 mm/sec for STFT in the region of the cubic to tetragonal transition.
Dissert. Abstr.

N69-26633 Texas Univ., Austin.
AN ELECTROKINETIC STUDY OF THE PLATINUM-POTASSIUM IODIDE SOLUTION INTERFACE
Jerre Thomas Anderson (Ph.D. Thesis) 1967 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-16166

The linear phenomenological equations are used to show that there are two groups of electrokinetic effects, one of which is free of complications arising from surface conductance because no conductance term is involved. It is shown that ac bridge measurements may lead to incorrect values for the conductance through an electrokinetic system. The linear equations are further used to develop characteristic curves for electrokinetic energy converters, and to show that meaningful electrokinetic measurements may be made under a wider variety of experimental conditions than were realized. The traditional model is used to develop an equation relating the zeta potential to the current resulting from fluid flow (the streaming current) that is valid for porous media as well as capillaries provided the electrical double layer is thin.
Dissert. Abstr.

N69-26640# Gt. Brit. Dept. of Scientific and Industrial Research. Warren Spring Lab.
FLOTATION AREAS OF SOME SILICATE MINERALS
R. M. Manser [1968] 31 p refs
(LR-67-(MST)) Avail: CFSTI

The flotation properties of a number of minerals from each structural group of silicates were determined using the technique of vacuum flotation. Each mineral investigated was tested with an anionic and a cationic collector over a wide range of pH values both in the presence and absence of the fluoride ion modifier. Clear patterns of flotation behavior were found to exist with the orthosilicate and framework silicate minerals. The flotation properties of minerals in both the amphibole and the pyroxene subgroups were found to be similar although exceptions do exist in each of these subgroups. Relationships were also found to exist between crystal structure and flotation properties for a number of different types of layer silicates.
Author

N69-26654# Northeastern Univ., Boston, Mass. Photochemistry and Spectroscopy Lab.
RESEARCH IN VACUUM ULTRAVIOLET ABSORPTION PROCESSES AND EXPERIMENTAL TECHNIQUES Final Report, 1 Jan. 1963–31 Dec. 1967
John L. Roebber 1 May 1968 148 p refs
(Contract AF 19(628)-2361)
(AD-683743; AFCRL-68-0474) Avail: CFSTI CSCL 7/4

The results of investigations of absorption and emission processes in gases important in upper atmosphere chemistry and physics by a wide variety of spectroscopic techniques are presented. The principle area studied is the vacuum ultraviolet at wavelength less than 3000 A using monochromators and spectrographs equipped with rare gas continua and hydrogen continua light sources. Sample cells suitable for work at 20K or between room temperature and 650K, gas chromatography apparatus for purifying samples, fluorescence apparatus to obtain the visible and ultraviolet emission spectra of gases excited by vacuum ultraviolet irradiation, an apparatus for flash photolysis studies, and data processing equipment are described. Experimental studies of the absorption spectrum of carbon suboxide, the fluorescence spectrum of the methoxyl radical, the flash photolysis of methyl nitrite and absorption and emission spectra of the products of a microwave discharge through sulfur dioxide are reported. Finally, theoretical calculations on the electronic structure of carbon dioxide and carbon suboxide are discussed. Author (TAB)

N69-26659# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
KINETIC STUDIES OF THE HYDRATED ELECTRON
Nathan Klein, James E. Fanning, Jr., Thomas L. Smith, and Harry N. Gephart Feb. 1969 34 p refs
(AD-683493; NDL-TR-120) Avail: CFSTI CSCL 7/4

The ultra-fast, second-order decay of the hydrated electron, e(aq)(-), first observed following nanosecond X-ray pulses in air-free, alkaline solution, has been studied in greater detail. The addition of alkali halide salts in low concentration strongly influences the kinetic behavior of the reaction, and it is suggested that e(aq)(-) reacts with a positive ion, tentatively assigned the formula H2O(+). The effect of structure on reactivity is discussed and methods of charge transfer and energy migration in solution are reviewed. The possible existence of a Wannier exciton in these solutions is suggested. Author (TAB)

N69-26676 Rutgers Univ., New Brunswick, N.J.
ABSORPTION OF ATMOSPHERIC SULFUR DIOXIDE BY NATURAL AND SYNTHETIC TEXTILE FIBERS
Constantine Joseph Gregory (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-17775

A laboratory study was performed to determine the rate and extent of removal of atmospheric sulfur dioxide by undyed fibers of wool, viscose rayon, nylon, and cotton. The mechanisms involved in the uptake of the gas were also investigated. Fiber samples were exposed to sulfur dioxide concentrations ranging from 0.78 to 5.25 ug./liter (0.3 to 2.0 ppm by volume). Exposure times varied from 60 minutes to 20 days. Textile fibers removed atmospheric sulfur dioxide at rates directly proportional to their moisture contents; when these moisture values were less than the saturation values. Rate curves for sulfur dioxide sorption by wool at a given moisture content less than saturation were characterized by a steadily decreasing rate of sulfur dioxide uptake. The chemical affinity of sulfurous acid for wool at 0 C was found to be −10.3 kg. cal. This value was used to calculate a titration curve for the reaction of wool with sulfurous acid. Dissert. Abstr.

N69-26680*# Arde, Inc., Mahwah, N.J.
LOW TEMPERATURE VAPOR PHASE CATALYTIC OXIDATION UNIT
B. J. Intorre and R. H. Alper Apr. 1969 55 p
(Contract NAS1-7025)
(NASA-CR-66697) Avail: CFSTI CSCL 07C

A low temperature vapor phase catalytic oxidation unit using Ardox catalyst has been designed, built, and tested for its ability to oxidize organics entrained in vapor from the vacuum distillation of urine. The lightweight unit consists of a low temperature catalyst bed with an insulated heat exchanger. The unit was tested by distillation of aqueous solutions of various organic compounds, aqueous solutions of ammonia, and urine. The distillation of dilute solutions of pure organic compounds yielded information on the expected behavior of urine constituents during distillation. Urine distillation was carried out under varied conditions of distillation temperature and catalyst bed temperature. The recovered water was analyzed. Performance data for the unit are presented, and estimates are made for catalyst life and power requirements. Author

N69-26681*# Hamilton Standard, Windsor Locks, Conn.
RESEARCH AND DEVELOPMENT PROGRAM FOR A COMBINED CARBON DIOXIDE REMOVAL AND REDUCTION SYSTEM. SUPPLEMENT 1, PHASE 2A: PHYSICOCHEMICAL PROPERTIES OF LITHIUM CHLORIDE LITHIUM CARBONATE MELT MIXTURES
J. O'M. Bockris (Pennsylvania Univ.), A. Calandra (Pennsylvania Univ.) and C. Solomons (Pennsylvania Univ.) Feb. 1969 93 p refs
(Contract NAS1-4154)
(NASA-CR-66519A; HSER-4908-Suppl-1) Avail: CFSTI CSCL 07D

Experimental studies of liquid mixtures of lithium chloride and lithium carbonate were conducted at temperatures between 550°C and 800°C for a range of compositions including the eutectic. Viscosity, density, and surface tension were measured by suitable modifications of a linear oscillation viscometer. Contact angles with POCO AX and spectroscopically pure graphite were also observed as functions of composition and temperature. Self-diffusion coefficients for carbonate ions in the eutectic mixture were determined by radioisotope tagging of carbonate ions with C^{14}, enabling measurement of diffusion of carbonate into a capillary tube from an external phase. Laboratory techniques, evaluation of precision, and measured physico-chemical properties are presented in detail. Author

N69-26691# Trinity Coll., Dublin (Ireland). School of Engineering
PRESSURE DEPENDENCE OF THE DIELECTRIC PROPERTIES OF SOME ORGANIC LIQUIDS AND OF FIFTEEN OF THE ALKALI HALIDES Final Scientific Report
Brendan K. P. Scaife, William G. S. Scaife, Kamal R. Mahmud, and Kondadi Kamath 12 Aug. 1968 176 p refs
(Contract AF 61(052)-843)
(AD-683351; AFOSR-69-0383-TR) Avail: CFSTI CSCL 7/4

Measurements are reported of the pressure dependence of the permittivity of n-pentane, n-hexane, n-heptane, n-octane, n-decane, carbon disulphide, eugenol, glycerol, diethyl ether, LiF, LiCl, NaF, NaCl, NaBr, NaI, KF, KCl, KBr, KI, RbBr, RbI, CsBr, CsI (single crystals). Temperature range 0-100 deg C, pressure range 1-4,000 kgf/sq. cm, frequency range 20-8 million Hz. Temperature dependence of the permittivity of alkali halides measured and dielectric dispersion in glycerol and eugenol investigated. Author (TAB)

N69-26698 Kansas State Univ., Manhattan.
KINETICS AND THERMODYNAMICS IN COVALENT TROPILIDENE-TROPYLIUM ION SYSTEM
Yuan-Chang Chiang (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-17500

The equilibrium involving competition between protons and tropylium ions for a nucleophile Nu^- can be considered as the sum of two equilibria. The K_a can be obtained by measuring the equilibrium between tropylium ion and the conjugate acid of the nucleophile; the proton-basicity of the nucleophile can be obtained by measuring the acidity of the conjugate acid; and the carbon-basicity of the nucleophile can be obtained by multiplication of the above two constants. Fragmentation of tropylacetone was found to react by a unimolecular process in which the rate-determining step involves the breaking of the C-Tr bond of tropylacetone protonated in a pre-equilibrium step. The presence of trace of water was found to slow down the reaction in terms of hydration of the protons. The result of deuterium exchange reaction during the fragmentation process showed a usual keto-enol tautomerism of the ketone with a reaction rate comparable to the fragmentation reaction. Dissert. Abstr.

N69-26717 Kansas Univ., Lawrence.
ELECTROCHEMICAL STUDIES OF GOLD(I) IN ACETONITRILE. 1. EXTRACTION OF TETRABUTYLAMMONIUM TETRACHLOROAURATE (III). 2
Orlando Bravo (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-17361

An external reference electrode (A.C.E.) was prepared for electrochemical studies in acetonitrile. The half-cell: Hg, Hg_2Cl_2, KCl, $KClO_4$ | Et_4NClO_4 (0.1 M, AN) || was found to be stable and reproducible (± 0.2 mv). The electrode was found to have a potential of −0.297 v vs. $(E^{0.01}{}_{Ag})_{AN}$ (corrected for E_j) at 25°. Gold (I) solutions in acetonitrile were studied potentiometrically in a constant ionic medium (0.1 M Et_4NClO_4) at 25°C. The formal potential of the gold-gold(I) couple was found to be 1.348 ± 0.0005 v vs. A.C.E. Voltammetric and chronopotentiometric studies indicate that the electrodeposition of gold on a platinum electrode requires an overpotential of −0.14 ± 0.01 v. Voltammetric studies in the range +1 to +2.8 v (vs. A.C.E.) indicate that the potential of the gold(I)-gold (III) couple in acetonitrile solution must be more anodic than 2.8 v (vs. A.C.E.). Dissert. Abstr.

N69-26723 Kansas Univ., Lawrence.
FREE RADICAL CHEMISTRY OF ALCOHOLS
Kenneth LeRoy Johnson (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17405

The oxidation of primary and secondary alcohols by t-butyl peroxide has been shown to involve a hydrogen atom transfer from intermediate α-hydroxyalkyl radicals to oxygen of the peroxide in a chain reaction to give an induced decomposition of the peroxide. The rate of decomposition is best described as first-order in peroxide. This study was initiated to determine if the oxidation product of the alcohol was responsible for deviation from first order kinetics near the start of the reaction and for high boiling carbonyl containing products. The rate of decomposition of t-butyl peroxide in secondary alcohols is slower in the presence of added ketone. The ketones react in two different manners. Abstraction of an α-hydrogen from the ketone, probably by an α-hydroxyalkyl radical, results in formation of 1,4-diketones in a chain termination reaction. Dissert. Abstr.

N69-26725 Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.
DIFFUSION OF MOLYBDENUM AND CERIUM IN BETA-ZIRCONIUM
A. R. Paul, M. S. Anand, M. C. Naik, and R. P. Agarwala 1968 15 p refs
(BARC-377) Avail: CFSTI

Diffusion of molybdenum and cerium in beta zirconium was studied by residual activity technique in the temperature range of 880° to 1600°C. The results obtained, show a non-linearity in the plots showing temperature dependence of diffusivities, as observed in the self and impurity diffusion of niobium and vanadium in beta-zirconium, and low values of D_o and Q in the low temperature range. On the basis of dual mechanisms operating, the diffusivities (D cm^2/sec) in the above cases could be expressed as a sum of two exponentials. The non-linearity in the Arrhenius plots was explained on the basis of (1) extrinsic defects being introduced by the presence of residual impurities, and (2) enhancement due to the randomly oriented dislocations and (3) vacancy-divacancy model. Author

N69-26739 Rochester Univ., N.Y.
A STUDY OF THE INFRARED SPECTRA OF ALKALI GERMANATE GLASSES
Benjamin Teh-Kung Chen (Ph.D. Thesis) 1968 291 p
Avail: Univ. Microfilms: HC $13.30/Microfilm $3.75 Order No. 68-15827

The three alkali germinate systems investigated are Na_2O-GeO_2, K_2O-GeO_2, and Rb_2O-GeO_2. The measurements of vitreous germanium dioxide were carried down to 80 cm^{-1}. It was assumed that the short range order exists in glass network. The average structural unit that represents the short range order of the vitreous germanium dioxide network was derived from the X-ray work of Nelson and Siegel (58), Smith and Isaacs (76). A vibrational analysis involving the calculation of the vibrational frequencies of the normal modes of the average structural unit was carried out by using the FG-matrix technique and a group theoretical method. Three force constants are reported and the sixteen corresponding frequencies are compared with the measured spectra. In spite of the approximate nature of the structural unit and the calculations, the agreement between the observed and calculated frequencies is very good. Dissert. Abstr.

N69-26742*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
SYNTHESIS OF ELASTOMERS FOR USE WITH LIQUID FLUORINE Quarterly Letter Report, 1 Sep.–30 Nov. 1968
Henry C. Brown and A. R. Mukherjee 15 Dec. 1968 18 p
(Contract NSR-10-005-047)
(NASA-CR-101173; QR-7) Avail: CFSTI CSCL 07C

Attempts were made to use some trialkyl or triaryl phosphines as initiators for ionic polymerization of hexafluorobutyne-2 and its copolymerization with some suitable comonomers. Being ionic in nature, the rate of homopolymerization was extremely fast even at very low temperature in some cases. Little success was achieved in the copolymerization process. The reaction between hexafluorobutadiene and sulfur tetrafluoride in the presence of cesium fluoride as a catalyst was studied to examine the role of the catalyst in the process. Author

N69-26743 Polytechnic Inst. of Brooklyn, N.Y.
SINGLE-CRYSTAL-X-RAY DIFFRACTION STUDY OF WATER, DEUTERIUM OXIDE, WATER (O18) AND DEUTERIUM OXIDE (O18) HEXAGONAL ICE
Erika St. Handler (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-16247

Integrated intensity measurements were made on single crystals of the four isotopes at −50°C and −150°C using a counter Weissenberg diffractometer. The atomic coordinates and temperature factors were refined by the method of least squares. The centrosymmetric Pauling model of the ice structure was found to best describe the structure. The results of the refinement indicate only minor variations between the four isotopic forms. The lattice constants of the four isotopic ices were measured between −10°C and −170°C using a single crystal diffractometer. The substitution of D for H causes an expansion of the lattice at all temperatures. The effect of substituting O^{18} for O was less clear and appears to be temperature dependent. The coefficient of thermal expansion shows the normal behavior of decreasing as the temperature is lowered. The c/a ratio of all the ices is constant with temperature and significantly less than 1.6333, the ideal value for hexagonal close packing. Dissert. Abstr.

N69-26750# Olin Mathieson Chemical Corp., New Haven, Conn. Chemicals Group.

POLYMER CHEMISTRY OF BORON CLUSTER COMPOUNDS

Hansjuergen A. Schroeder Mar. 1969 39 p refs
(Contract Nonr-3395(00))
(AD-683669; TR-41) Avail: CFSTI CSCL 7/2

To achieve the goals of a research effort aimed at the synthesis of basically inorganic polymers with superior heat and oxidation resistance, a chain polymer approach was pursued. Large three-dimensional boron cluster compounds were linked via strong bonds resulting in three classes of polymers distinguished by high thermal stability. The first of these are thermosetting resins in which decaborane nuclei are joined through P-O-P or P-N=P linkages. They will crosslink between 500 and 650F and the resulting network polymers can serve as binders in asbestos-reinforced plastic structures. Their retention of physical properties after heat-aging at 800 to 900F for extended periods (e.g. 1000 hours) in air is outstanding. The icosahedral carboranes, especially the meta and para isomers, are ideally suited for the synthesis of flexible and thermoplastic-like species. Progress has especially been achieved in the development of the silicone related m-carboranesiloxanes (DEXSIL polymers) in which m-carborane moieties are linked via siloxy groups. Their use as high-temperature elastomers and coatings is now being pursued for various industrial applications between 600 and 900F. Joining m- and particularly p-carborane moieties by single-atom bridges such as sulfur or tin affords long-chain polymers with exceptionally high softening points. Author (TAB)

N69-26763# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE EFFECT OF IMPURITY MOLECULES ON THE TRIPLET-SINGLET TRANSITION IN CRYSTALLINE NAPHTHALENE

V. I. Melnik *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 426–430 refs (See N69-26751 14-23)
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An attempt was made to elucidate the mechanism of phosphorescence of crystalline naphthalene activated by impurity molecules. Diphenlacetylene, dibenzyl, benzophenone, acetophenone, phenanthrene, azobenzene, fluorene, diphenylamine, carbazole, and diphenylene oxide were used as the impurities. The tests were made at liquid hydrogen temperature. An interpretation was made of the spectra with each impurity. It was concluded that none of the currently available mechanisms fully explains the phosphorescence of crystalline naphthalene. The hypothesis of deformed molecules seems to be most attractive, but it requires further corroboration. B.P.

N69-26768# Israel Program for Scientific Translations, Ltd., Jerusalem.

SOME PHYSICAL PROPERTIES OF ACETIC ANHYDRIDE + WATER SOLUTIONS

Ya. I. Dutchak et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 453–455 ref (See N69-26751 14-23)
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Viscosity, density, and surface tension were measured in the water–acetic anhydride system in a wide range of temperatures and concentrations. These physical properties were investigated to determine their relationship with the phase diagram of the system, where at 0.5M H_2O concentration the components combine to give CH_3COOH. Author

N69-26771# Israel Program for Scientific Translations, Ltd., Jerusalem.

SOLID SOLUTIONS IN THE InAs-CdS SYSTEM

A. V. Voitsekhovskii et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 461–462 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

Solid solutions of InAs-CdS were synthesized. The dependence of the lattice parameter, microhardness, electrical conductivity, mobility, and differential thermal e.m.f. is depicted as a function of molecular composition for the solutions. B.P.

N69-26773# Israel Program for Scientific Translations, Ltd., Jerusalem.

ELECTRICAL TRANSFER AND ELECTRICAL RESISTANCE PARAMETERS OF IMPURITY ATOMS IN LIQUID LEAD

P. P. Kuzmenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 464–465 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

Measurements were made on the electrical transfer parameter and electrical resistance parameter of Sb, Ga, and In in liquid lead at 350°C. The diffusivities of the impurity atoms were also determined. B.P.

N69-26779# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE TEMPERATURE COEFFICIENT OF THE VELOCITY OF SOUND IN LIQUIDS AND RAO'S RULE

Y. V. Zotov et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 476–479 refs (See N69-26751 14–23)
Copyright. Avail: CFSTI

Using an empirical relation derived between the isothermal compressibility and the surface tension of a liquid, an equation is written and applied to determine the temperature coefficient of the velocity of sound in liquids. The coefficient of volume expansion of the liquid is related to its critical temperature. Data are presented comparing the calculated and experimental values of the temperature coefficient of the velocity of sound for ten different liquids, and are found to be in satisfactory agreement. The ratio of the temperature coefficient of the velocity of sound to the coefficient of volume expansion of the liquid is found to be a function of temperature, and not constant, as follows from Rao's rule. This ratio is related to various macrophysical parameters, and is equal for various liquids, increasing with the increase in temperature. Its values are calculated for three normal liquids in a wide range of temperatures and are presented in tabular form. P.A.B.

N69-26785# Israel Program for Scientific Translations, Ltd., Jerusalem.

FORMATION OF NAPHTHOL IN CRYSTALLINE NAPHTHALENE

V. A. Lisovenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 493–495 refs (See N69-26751 14-23)

Copyright. Avail: CFSTI

A study showing the formation of naphthol impurities in naphthalene as the result of photochemical transformations in the solid and gas phase is summarized. An attempt is made to interpret the mechanism of naphthol formation in crystalline naphthalene on the basis of low temperature spectroscopic studies. The luminescence spectrum of a naphthalene crystal, whose vapor was exposed to the unfiltered light of a mercury arc during the process of growth, is supplied; the spectrum has a high-intensity series of bands which are in perfect correspondence with the β-naphthol impurity in crystalline naphthalene. The phosphorescence spectrum of crystalline naphthalene is a series of bands whose position and frequency range coincide with those in the phosphorescence spectrum of α-naphthol impurity. A decrease in the luminescence quantum yield of crystalline naphthalene upon irradiation indicates that photochemical reactions produce not only β-naphthol but also impurity centers which trap the electron excitation energy. The process of sparking is considered. It is concluded that naphthols form due to replacement of α- and β-deuterium atoms with OH radicals. P.A.B.

N69-26789# Israel Program for Scientific Translations, Ltd., Jerusalem.

CHEMICAL SENSITIZATION OF CADMIUM SULFIDE SINGLE CRYSTALS

V. A. Tyagai et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 502–504 (See N69-26751 14-23)

Copyright. Avail: CFSTI

In a study of the action of various etching agents on the photoelectric properties of CdS, it was established that chemical etching of unsensitized crystals with a high dark resistance markedly increases the CdS photosensitivity. Data are presented in tabular form which show the sensitization effect to be very pronounced, to be reproducible for all the crystals tested, and to be stable in time. Sensitized crystals were subjected to progressive etching in 6 M HCl solution, in order to study the nature of sensitization. A figure is supplied which plots the spectral distribution of photoconductivity and the intrinsic lifetime. The data indicate that the principal photoelectric properties of sensitized CdS crystals are similar to the properties of naturally photosensitive crystals. An explanation of the sensitization mechanism is proposed in terms of the formation of aggregated defects in the crystal lattice. P.A.B.

N69-26805# Picatinny Arsenal, Dover, N.J. Feldman Research Labs.

RESULTS OF LABORATORY STUDIES ON TRIEX-8 DEXTRINATED LEAD AZIDE

Louis Avrami and Henry J. Jackson Feb. 1969 45 p refs (AD-683469; PA-M-1877) Avail: CFSTI CSCL 19/1

Laboratory tests including the 100C vacuum stability test, DTA, TGA, x-ray diffraction analysis, impact sensitivity and electrostatic spark sensitivity were conducted on two different samples of dextrinated lead azide. One of the two samples was 25 years old while the other was recently manufactured. Author (TAB)

N69-26810# Technische Hogeschool, Eindhoven (Netherlands).

RETENTION OF VOLATILES DURING THE AIR DRYING OF AQUEOUS CARBOHYDRATE SOLUTIONS

Lambertus Christiaan Menting (Ph.D. Thesis) 18 Feb. 1969 81 p refs

Avail: CFSTI

When juices and extracts with a dry matter content above 40% are spray dried, the retention of aroma components is surprisingly high, even for those components which are much more volatile than water. Acetone is taken as a model for a volatile aroma component, and its retention during air drying is investigated in detail and explained. An aqueous solution of partially hydrolysed starch (malto-dextrin) served as a model juice or extract. The acetone concentration in drying droplets and slabs of this solution was measured and the influence of the most important factors on the acetone retention was examined. More rapid drying generally resulted in a higher acetone retention. The most striking effects on retention were those of the relative humidity of the drying air and the malto-dextrin concentration of the solution. Although, in an aqueous 400 g/l solution of malto-dextrin at 20°C, acetone is approximately 90 times more volatile than water, an acetone retention of almost 80% was measured after the solution had been rapidly dried. This high retention is found to be caused by an almost dry film which forms at the surface of the liquid. The film is permeable to water but almost impermeable to acetone. Its selectivity is not due to sorption of acetone. Author

N69-26811 California Univ., San Diego.

ELECTROPHILIC SUBSTITUTION AT THE CARBON-BORON BOND. THE MECHANISM OF PROTODEBORONATION OF BENZYLBORONIC ACIDS

Diana Lee Stiggall (Ph.D. Thesis) 1968 249 p

Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 68-17465

The base-catalyzed solvolysis (protodeboronation) of benzylboronic acid has been investigated with regard to kinetics, solvent effects, substituent effects, and solvent deuterium isotope effects at 80°C. The reaction in water, methanol, n-butanol, and 80% dioxane-water follows pseudo-first-order kinetics at a given base concentration, and there is virtually complete conversion to the boronate anion at pH's above 12 in water. The reduction in rate can probably be attributed to the lower electrophilicity of methanol compared to water. Electron withdrawing substituents in the benzyl group facilitate the cleavage and electron donating groups retard it, a result which suggests that negative charge is developed on the benzylic carbon during the transition state. Solvent deuterium isotope effects were determined by a competition method and the product composition was measured with a mass spectrometer at low ionizing voltage. Dissert. Abstr.

N69-26826# Naval Research Lab., Washington, D.C.

THE WETTABILITY OF FLUOROCARBON AND CHLOROCARBON TRIALKOXYSILANE FILMS ADSORBED ON GLASS AND METAL SURFACE Interim Report

W. D. Bascom 31 Dec. 1968 17 p refs

(AD-683661; NRL-6818) Avail: CFSTI CSCL 7/4

Adsorbed films having a wide range of wettabilities have been formed on silica, Pyrex, aluminosilicate, alpha-alumina, steel, and gold by trialkoxysilane (and trichlorosilane) compounds. These compounds had the general formulas RSi(OR)3 or RSiCl3, where R- was a fluorocarbon or a chlorocarbon group and -OR was -OCH3 or -OCH2CH3. The fluorocarbon films had gamma values of <20 dynes/cm and water contact angles of 100 to 118 degrees. The chlorocarbon films had gamma values of >40 dynes/cm and water contact angles of 80 to 90 degrees. Film thickness, determined by ellipsometry, was consistently greater than a monolayer of the trialkoxysilane. Desorption experiments suggest that the films were composed of a polysiloxane network along with unhydrolyzed adsorbate, small polysiloxane molecules, and solvent. The fluorocarbon compounds have potential for forming oleophobic barrier films in lubricated devices. Author (TAB)

N69-26843# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

SCALING BEHAVIOUR IN THE MICROSCOPIC APPROACH TO THE THEORY OF SUPERFLUID HELIUM

F. De Pasquale and E. Tabet 16 Dec. 1968 10 p refs (ISS-68/42) Avail: CFSTI

The critical behavior of superfluid helium is investigated in the framework of the microscopic theory. It is shown that the existence of the critical and hydrodynamical region is connected to the analytical properties of the superfluid density ρ_s (k,T) as a function of external thermodynamical parameters. In a simple model, the results of the phenomenological theory of Ferrell et al are recovered. Author

N69-26851 Kansas Univ., Lawrence.
THE HETEROGENEOUS PHASE BEHAVIOR OF THE HYDROGEN-PROPANE, CARBON MONOXIDE-PROPANE AND HYDROGEN-CARBON MONOXIDE-PROPANE SYSTEMS
Donald Bruce Trust (Ph.D. Thesis) 1968 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-17457

The purpose was to determine experimentally the phase relations of the hydrogen–propane, carbon monoxide–propane, and hydrogen–carbon monoxide–propane systems. A second objective was to determine whether carbon monoxide and the normal alkanes (methane, ethane, propane, and butane) exhibited liquid phase immiscibility at temperatures below the critical temperature of carbon monoxide. Experimental vapor–liquid composition data were taken with a static equilibrium cell that could be maintained constant at any temperature between −196°C and +75°C. A brass equilibrium cell capable of pressures up to 3000 psi was used when samples of vapor and liquid were taken. Vapor and liquid samples were taken directly from this cell into a gas chromatograph for analysis. Glass equilibrium cells were used for visual observation of phase boundaries at pressures up to 600 psi. Dissert. Abstr.

N69-26853 Kansas Univ., Lawrence.
THE EFFECT OF THE COMPRESSIBILITY FACTORS OF METHANE AND METHANE-PROPANE CAUSED BY THE ADDITION OF N-HEPTANE, METHYLCYCLOHEXANE, AND METHYLBENZENE OR MIXTURES THEREOF
Darryl Sonnley Roberts (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-17443

When the mole fraction of the heavy material in natural gas is held constant, variations in the amounts of paraffinic, naphthenic, and aromatic hydrocarbons within a heavy fraction may significantly influence the P-v-T behavior of the gas. The P-v-T data were measured with variable volume–constant mass equipment. The variable volume was accomplished using a movable piston fitted with o-rings. Synthetic gas mixtures were used since this enabled the author to control the compositions of mixtures tested by combining measured quantities of the pure components. N-heptane, methylcyclohexane, and methylbenzene were used in the investigation to represent the paraffinic, naphthenic, and aromatic components of the heavy fraction. Dissert. Abstr.

N69-26854 Utah Univ., Salt Lake City.
AMMONIUM-PERCHLORATE DIFFUSION FLAMES–A SPECTROSCOPIC INVESTIGATION
William Russell Aiman (Ph.D. Thesis) 1968 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-14412

Diffusion flames between a body of ammonium perchlorate (AP) and various fuel sources, solid polybutadiene-acrylic-acid copolymer or gaseous methane or hydrogen, were investigated spectroscopically over a wavelength range of 0.3 to 5.5μ with a Warner-Swasey model 501 millisecond scanning spectrometer. With gaseous fuels, the flame was approximately in the center of the gap between the fuel source and the surface of the AP. An AP vs. AP flame was produced, but it was totally nonvisible to the eye. The polymer flames were very close to the fuel surface. Spectrograms are published for the hydrogen vs. AP, methane vs. AP, AP vs. AP, and polymer vs. AP flames in the 1.9-to-4.7μ range. For the methane vs. AP flame, temperatures of about 2400°K were measured by a sodium-D-line-height-comparison technique as a subsidiary study. No significant variation in the temperature across the gap was revealed by this technique. Dissert. Abstr.

N69-26855 Wisconsin Univ., Madison.
STUDIES ON INERT AND REACTING FLUID MIXTURES
Dale Erwin Nierode (Ph.D. Thesis) 1968 248 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-13652

The pvT equations of state for mixtures were tested by gauging their ability to predict other thermodynamic properties that are functions of the pvT information. Specifically, the state relations involved were the Benedict-Webb-Rubin equation, the virial equation, and a corresponding states equation of state. One such property tested was the acoustic velocity. Acoustic measurements were taken using the modified, constant geometry, reflecting, sound tube of El-Hakeem. A new experimental method called amplitude detection was implemented and found to involve less inherent error than any of the other methods proposed for the El-Hakeem apparatus. Acoustic isotherms at 32°F are presented for various mixtures of methane (CH_4), Freon-14 (CF_4), nitrogen (N_2), and argon (A) from 0 to 70 atmospheres pressure. The three equations of state were found to agree qualitatively with the data, but the agreement was not as precise as that found by Lewis (±0.1%) for pure components with the same experimental apparatus. Dissert. Abstr.

N69-26862 Texas Technological Coll., Lubbock.
THE KINETICS OF METHYLCYCLOPENTANE REACTIONS OVER A PLATINUM ON η-ALUMINA CATALYST
Fernando C. Vidaurri, Jr. (Ph.D. Thesis) 1968 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-17555

This research was primarily concerned with the investigation of the kinetics of the reactions of methylcyclopentane (MCP) over a platinum on η-alumina catalyst. The major reaction products were found to be benzene (BZ), cyclohexane (CY), and the ring opening products: 2-methylpentane, 3-methylpentane, and *n*-hexane. Methylcyclopentene was also detected at a smaller concentration level. The kinetics of the reactions were studied in a differential reactor over a temperature range of from 810 to 870°F, a total pressure range of from 300 psig to 600 psig, a modified Reynolds number range of from 13.4 to 33.8, at 3/1 and 4.7/1 hydrogen to hydrocarbon ratios, and with feedstocks containing: (1) MCP, (2) 6.1 mol per cent BZ in MCP, and (3) 5.2 mol per cent CY in MCP. Good kinetic data were obtained over these ranges, having an average relative error in the rates of about 5 per cent. Dissert. Abstr.

N69-26866 Wisconsin Univ., Madison.
THE KINETICS OF THE PLATINUM-CATALYZED VAPOR-PHASE HYDROGENATION OF BENZENE
David Edward Quady, Jr. (Ph.D. Thesis) 1968 459 p
Avail: Univ. Microfilms: HC $20.70/Microfilm $5.85 Order No. 68-13656

The kinetics of the vapor-phase catalytic hydrogenation of benzene was studied using a commercial platinum-alumina catalyst, Sinclair-Baker RD-150, and a batch differential recycle reactor. Data were taken at 500°F, and at total pressures up to 200 psia. Measured conversions ranged from 0.40 to 99.5%, and rates ranged from 0.0080 to 4.57 g-moles per hour per gram of catalyst.

The rates were unusually high, for this type of catalyst. The high rates may have been caused by differences in pretreatment of the catalyst. The effects of heat and mass transfer on the data were minimized by using small catalyst particles and by maintaining a high flow rate through the catalyst bed. A study was made of the susceptibility of the catalyst to poisoning. Screening experiments showed that contact at 500°F with air, water, or high hydrocarbon partial pressures deactivated the catalyst. Subsequent contact with high hydrogen pressures partially restored the activity. Dissert. Abstr.

N69-26867# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE PRINCIPLES OF COMPUTING THE EFFECTIVE PARAMETER OF POROUS GAS-DIFFUSION ELECTRODES WITH REGULAR (GLOBULAR) STRUCTURE
Iu. I. Golovkin et al [1969] 8 p refs Transl. into ENGLISH from Electrokhimiya (Moscow), v. 5, no. 2, 1969 p 166–171
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The effective parameters of a porous gas-diffusion electrode were determined by computational means by using a model electrode of regular (globular) structure. The computational results were compared with experimental data on a study of the dependence of the current density on the gas–electrolyte pressure drop. The cathodic reduction of oxygen on a promoted nickel–nickel oxide electrode in 5.3 N KOH at 100° to 200°C, 40 atm pressure, and 0.3 v polarization constant was the model reaction. Author

N69-26870# Iowa Univ., Iowa City
SYNTHESIS OF LADDER POLYMERS VIA ONE- AND TWO-STEP CONDENSATION POLYMERIZATIONS
Michael Eric Freeburger (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-16799

The polymerization of 2,5-dihydroxy p-benzoquinone (II), 2,5-diacetoxy p-benzoquinone (II), and 2,5-dihydroxy 3,6-dichloro p-benzoquinone (III) with 4,6-diaminoresorcinol dihydrochloride (IV) has been investigated. When hexamethyl-phosphoramide (HMP) was employed as solvent, ladder polyphenoxazines such as V were produced; when tetrahydrofuran (THF) was employed as solvent, linear poly-Shiff's bases such as VI were produced, which could be converted to the ladder phenoxazines by heating in HMP. These polymers began a slow decomposition at ca. 275°C in a nitrogen atmosphere. The polymerization of 3,3,6,6-tetramethylcyclohexan-1,2,4,5-tetraone (VII) with 1,2,4,5-tetraaminobenzene (VIII) and with 2,3,6,7-tetraaminodibenzodioxane tetrahydrochloride (IX), to produce ladder polyquinoxalines such as X, containing double aliphatic linkages, was investigated. Dissert. Abstr.

N69-26871 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE DISSOLUTION KINETICS OF Fe_3C IN FERRITE
Francis Vincent Nolfi, Jr. (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-17830

Analytical expressions are developed for the kinetics of dissolution of a spheroidized, solute rich stoichiometric precipitate in the surrounding matrix. There are two limiting cases; in one the rate of dissolution is determined by long range solute diffusion through the matrix and in the other by the transfer of atoms across the matrix-precipitate interface. In the latter case the region of the interface is not in equilibrium which is interpreted as interfacial reaction control of dissolution. The analysis considers only first order kinetics. The major assumptions are (a) only the solute diffuses (b) the precipitates are uniform in size and distribution throughout the matrix (c) the precipitate-matrix interface is stationary (d) the solute diffusion coefficient, D, in the matrix is constant and (e) concentration gradients provide the only driving force for dissolution. Dissert. Abstr.

N69-26872 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE KINETICS OF GASEOUS SELECTIVE OXIDATION OF BINARY AND TERNARY ALLOYS OF LIQUID IRON
Robert S. Kaplan (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-17625

A study has been made of the oxidation kinetics of elements dissolved in molten iron in an effort to determine the mechanisms by which these reactions occurred. Levitated samples of Fe–C, Fe–Si, Fe–C–Si, Fe–C–P, Fe–C–Mn and Fe–C–S alloys were melted under pure helium and then exposed to helium mixtures with either 5 or 10 percent oxygen at various temperatures in the range 1850° to 2050°C for varying periods of time. The concentrations of the alloying elements were found to decrease linearly with time. The decarburization rate was fastest in the Fe–C–P alloy, slower in the Fe–C and Fe–C–Si alloys and slowest in the Fe–C–S alloy. At the temperatures attained during the research, silicon did not oxidize prior to carbon, and phosphorous was not oxidized. Sulfur appeared to oxidize during the first ten seconds of a run. Dissert. Abstr.

N69-26882 Kansas Univ., Lawrence.
A CONDUCTANCE STUDY OF QUATERNARY AMMONIUM HALIDES IN DIMETHYL SULFOXIDE
Dale Eugene Arrington (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-17351

Conductance measurements at 25°C were made on a series of quaternary ammonium halides in dimethyl sulfoxide over the concentration range 1×10^{-4} to 1×10^{-3} molar. Tetramethyl- to tetra-*n*-heptylammonium iodide; tetramethyl- to tetra-*n*-butylammonium bromide; and tetrapropylammonium chloride were used as solutes. The conductance data were analyzed by the Fuoss–Onsager conductance theory, and limiting equivalent conductances and ion-size parameters were obtained from the data. Single-ion conductances were determined using tetraisoamylammonium tetraphenylboride and tetraisoamylammonium tetraisoamylboride as reference electrolytes. Ion conductances decreased as the size of the cation increased and the results are compared with those obtained in several other solvents. Dissert. Abstr.

N69-26884 California Univ., Los Angeles.
AROMATIC AND INNER SHELL IONS: INERT AND DESTRUCTIVE SPECIES IN RADIATION CHEMISTRY
Peter Leon Hamlet (Ph.D. Thesis) 1968 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-16606

The chemistry of benzene positive ion, $C_6H_6^+$, was examined to help explain why benzene and other aromatic compounds show less radiation damage in the condensed phase than do other hydrocarbons. A mass spectrometric study was performed on benzene at pressures up to 1 Torr. The results showed that ground state $C_6H_6^+$ ion was inert in gaseous benzene and was rapidly formed by electron transfer from C_6H_6 to benzene fragment ions such as $C_4H_4^+$. These results were confirmed by making fragment ions selectively through the use of electron transfer reactions from benzene to rare gas ions. To avoid radiation damage in liquid benzene, the inert $C_6H_6^+$ ions produced by gamma radiolysis must avoid decomposition in the very exothermic process of charge recombination. It was suggested that electron capture by benzene would sufficiently slow the electron's return to the cation to permit nondestructive dissipation of the recombination energy via a charge transfer complex made from $C_6H_6^+$ and C_6H_6. Dissert. Abstr.

N69-26888 Carnegie-Mellon Univ., Pittsburgh, Pa.
IONIC TRANSPORT IN THE QUIESCENT ELECTROCHEMICAL CELL

Howard J. Hickman (Ph.D. Thesis) 1968 202 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-17652

The essential equations describing ionic transport in a quiescent one dimensional electrochemical cell are treated indepth. The diffusion equation with second order kinetic and transference terms, together with Poisson's equation are attacked by singular perturbation methods. This approach reveals the boundary layer nature of the problem: gradients of concentration and potential are shown to be large near the electrodes and small elsewhere. The classical assumptions of local electrical neutrality and ionization equilibrium are thus shown to be valid everywhere within the cell except for thin regions near the electrodes. It is shown that the equation for the diffusion of the salt which produces the ions must be retained. A new parameter β, related to the degree of ionization, is shown to characterize the behavior of the cell in a significant way. Dissert. Abstr.

N69-26894# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
CsCl DENSITY GRADIENT STUDY OF SOME MODIFICATIONS INDUCED BY U.V. LIGHT ON THE DENATURED MOLECULE OF THE T_2 PHAGE DNA [STUDIO IN GRADIENTE DI CsCl DI ALCUNE MODIFICAZIONI INDOTTE DALL'U. V. SULLA MOLECOLA DEL DNA DENATURATO DEL FAGO T_2]
M. Cremonese, C. Giampaoli, M. Matzeu, Ang G. Onori 16 Dec. 1968 39 p refs In ITALIAN; ENGLISH summary
(ISS-68/43) Avail: CFSTI

The behavior of the modifications due to the UV radiation on the denatured phagic DNA has been followed, looking at the changes of density in CsCl gradient, after irradiation with increasing doses of monochromatic light. The spectral range studied is 2300-2900 Å, with a wave length resolution $\Delta\lambda = \pm 20$ Å. The effect observed is a gradual shift towards the higher densities, as the UV dose absorbed by the irradiated material increases. The experimental curves show an exponential behavior and the analysis of the action spectra indicate the thymine as the main responsible for the observed effect. An evaluation of the quantum efficiency for thymine-dimers formation gives a constant value of $(18 \pm 3) \times 10^{-3}$ quantity $^{-1}$. Author

N69-26900 Rutgers Univ., New Brunswick, N.J.
PERTURBATION OF SURFACE HYDROXYL GROUPS ON POROUS VYCOR GLASS BY AROMATIC π-ELECTRON SYSTEMS
James Anthony Cusumano (Ph.D. Thesis) 1968 294 p
Avail: Univ. Microfilms: HC $13.30/Microfilm $3.80 Order No. 68-17763

The reaction of benzene and several other monosubstituted benzenes with porous Vycor glass surfaces was studied in detail by means of infrared absorption spectroscopy. Complementary thermodynamic data were calculated from adsorption isotherms obtained using a sensitive micro-balance. The credibility of a charge transfer mechanism is discussed. Dissert. Abstr.

N69-26903 Cornell Univ., Ithaca, N.Y.
A MASS SPECTROMETRIC INVESTIGATION OF REACTIONS OF SOME SIMPLE HALOCARBONS AND BORANES
Carleton Everett Perrin (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-15733

The formation of CF_2 and C_2F_4 in high temperature pyrolysis of fluorcarbons was studied mass spectrometrically. The reactants CF_2HCl, $C_2F_4Cl_2$, and F_2 were passed through a graphite tube furnace at 1000-2400°K. In each case, the relative intensities of CF_2^+ (CF_2) and $C_2F_4^+$ (C_2F_4) were determined as a function of temperature. Ion rearrangement processes were investigated in an electron impact study of CFCl = CFCl and its isomer $CF_2 = CCl_2$. The stoichiometry of oxidation of B_5H_9, B_4H_{10} and BH_3CO was followed during slow addition of O_2 to a borane sample at pressures between 5 and 20 mm. Thermal decomposition of B_2H_6 to H_2, volatile hydrides and solid polymer was observed at 175-235°C. At each temperature the rate order and rate constant for decay of B_2H_6 were determined Dissert. Abstr.

N69-26950 Cornell Univ., Ithaca, N.Y.
NUCLEAR MAGNETIC RESONANCE, INFRARED, AND ELECTRONIC SPECTRAL STUDIES, AND DIPOLE MOMENT STUDIES OF SOME β-DIKETONATE COMPLEXES OF GROUP IV ELEMENTS
Nick Serpone (Ph.D. Thesis) 1968 249 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 68-16764

A series of complexes of the type $Ti(dik)_2X_2$ (dik = anion of 1-phenyl-1,3-butanedione, bzac, and 1,3-diphenyl-1,3-propanedione, bzbz; X = F, Cl, Br or OC_2H_5) has been prepared and characterized. Microscopy and X-ray powder patterns indicate that the solid dichlorides and dibromides are isomorphous. Molecular weight and conductance measurements show that these complexes behave as monomeric non-electrolytes in nitrobenzene. A series of cationic acetylacetonato complexes, and anionic benzoylacetonato and trifluoroacetylacetonato complexes has also been prepared. Dissert. Abstr.

N69-26951 Johns Hopkins Univ., Baltimore, Md.
INVESTIGATIONS ON STRUCTURE AND INTERACTIONS OF NUCLEIC ACIDS AND THEIR COMPONENTS BY PROTON RESONANCE
Martin Paul Schweizer (Ph.D. Thesis) 1968 282 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65. Order No. 68-16479

Proton magnetic resonance (pmr) studies on nucleic acids and their components have established several fundamental properties concerned with their structure and interactions. Regarding electronic configurations of bases in purine nucleosides, reasonable correlations were obtained between measured chemical shifts and values calculated from considerations of excess π-electron densities, ring currents and nitrogen atom magnetic anisotropy. Base methylation of certain purine nucleosides produced polar ground state resonance forms. The deoxyribose ring in 3'-deoxyadenosine was shown to have a conformation altered from that of other adenosines. Bases, nucleosides and nucleotides interact intermolecularly via vertical stacking of base rings. These associations are enhanced by base substitution of hydrophobic methyl groups and the tendency to interact, as detected by pmr, is A>G>C>U. A model for the association of these monomers has been proposed. Dissert. Abstr.

N69-26970# Ohio State Univ. Research Foundation, Columbus.
HIGH RESOLUTION VIBRATION ROTATION SPECTRA OF POLYATOMIC MOLECULES Final Report, 1 Apr. 1963-31 Dec. 1968
Harald H. Nielsen and K. Narahari Rao Dec. 1968 211 p refs
(Contract AF 19(628)-2756)
(AD-683339; AFCRL-69-0016) Avail: CFSTI CSCL 7/4

Detailed studies were conducted on the rotational structure of the infrared bands of linear molecules, symmetric tops, and asymmetric rotors employing high resolution and high precision infrared equipment. The specific molecules dealt with are CO2, H2O, C2H2, AsH3, HF and DF. Usefulness of the results obtained for interpretation of the water vapor laser emissions was recognized. Some of the laboratory spectra also play a significant role in the understanding of the high resolution infrared spectra of planets.

The techniques developed in the identification and interpretation of overlapping bands which normally occur in the infrared region were highly successful. The computer programs developed are also of use in processing speedily high resolution infrared spectra of small molecules. Author (TAB)

N69-27020# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
A TABLE FOR CONVERTING pH TO HYDROGEN ION CONCENTRATION OVER THE RANGE 6-9
Vincent Fiorica Oct. 1968 34 p refs
(AM-68-23) Avail: CFSTI

The wider use of hydrogen ion concentration [H+] rather than pH to describe and evaluate acid-base status will require interconversion of the two notations until a final standard is adopted. The relationship between pH and [H+] is given by the general expression pH = — log [H+]. Tables relating pH and [H+] were constructed according to the above expression and will eliminate the need for mathematical computation over a range covering most biological applications. Author

N69-27026# Bureau of Mines, Morgantown, W.Va.
EXPERIMENTS ON THE FLOW OF MERCURY IN A POROUS MEDIA IN A TRANSVERSE MAGNETIC FIELD
W. E. Wallace, C. I. Pierce, and W. K. Sawyer May 1969 17 p refs
(BM-RI-7259) Avail: Issuing activity

Volume rate of flow measurements were made of the flow of mercury through porous samples under conditions of no field, magnetic field transverse to the direction of flow, and transverse magnetic field and electric current to determine if a magnetic method might be potentially useful in the study of pore-size distribution. No change was observed in the flow rate from the application of a magnetic field alone. The application of both field and current produced an electromagnetic pumping action with or against the direction of flow, depending upon the direction of the electric current. This pumping effect was observed to be greater in a rectangular porcelain sample than the calculated value for an equal-sized open channel. Author

N69-27027# Bhabha Atomic Research Centre, Bombay (India).
CIRCULATION OF ACTIVATION ENERGY OF DECOMPOSITION REACTIONS FROM THERMOGRAVIMETRIC ANALYSIS
S. R. Dharwadkar and M. D. Karkhanavala 1968 22 p refs Presented at the 2d Intern. Conf. on the Thermal Anal., Worcester, USA, 18–23 Aug. 1968
(BARC-381) Avail: CFSTI

The values calculated are influenced by various experimental parameters, though the exact dependance is not known. The effect of sample size and heating rate on the values of activation energy for the dehydration of calcium oxalate monohydrate of uniform particle size was evaluated using the method of Horowitz and Metzger. The large variations observed were traced to the inherent limitations in the method of calculation. The equation was suitably modified so as to yield values of activation energy which are independent of the variation in sample size and heating rate. Author

N69-27045# Dow Chemical Co., Midland, Mich.
POLY[BIS(PHOSPHINATO)FLUOROALANES]
D. L. Schmidt and E. E. Flagg 10 Mar. 1969 29 p refs
(Contract Nonr-4968(00))
(AD-683788; TR-5) Avail: CFSTI CSCL 7/2

A new class of coordination polymers, poly(bis(phosphinato)-fluoroalanes), (A1(F)(OPRRO)2)n, where R,R = alkyl, phenyl or benzyl, was prepared and studied. The properties of these polymers are influenced by the phosphinate (R) substituents; polymers having n-alkyl groups with more than five carbons are flexible and exhibit unusual hydrolytic stability. A polymer was obtained with a degree of polymerization of 104 by incorporating a 2:1 ratio of benzyl(n-heptyl) and di-n-octyl phosphinate groups. The properties of the flexible materials are consistent with linear rather than highly crosslinked or network systems. Feasible structures are proposed for the polymers. Author (TAB)

N69-27057 Cornell Univ., Ithaca, N.Y.
STRUCTURE OF MOLTEN ORGANIC SALTS
Stephen Warren Rudich (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-16763

The purpose of this research was the further elucidation of the structure of dense fluids, and the gaining of greater insight into the role played by coulomb interactions in determining this structure. In order to achieve this, certain equilibrium and transport properties were investigated for the series of quaternary organic salts with spherically symmetric ions: $(propyl)_4NBF_4$, $(propyl)_4PBF_4$, and $(propyl)_4AsBF_4$. The properties studied for each of these compounds was the temperature dependence of density, electrical conductance, and viscosity, at one atmosphere pressure. It was found that at one atmosphere and a given temperature, the electrical conductance was ordered: arsonium salt greater than phosphonium salt, greater than ammonium salt. The viscosity was ordered: arsonium salt less than phosphonium salt, less than ammonium salt. At 250°C values for equivalent conductance were 32.0, 29.0, and 27.0 $cm^2/ohm.eq.$, respectively. Values for the viscosity were 1.63, 1.81, and 2.22 c.poise, respectively. Dissert. Abstr.

N69-27065 Iowa Univ., Iowa City.
MASS SPECTROMETRIC INVESTIGATION OF THE VAPORIZATION, THERMODYNAMICS, AND DISSOCIATION ENERGIES OF LaS, ScS, YS, ZrS, AND UO
Ronald Paul Steiger (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16863

The dissociation energies were determined mass spectrometrically through the study of gaseous isomolecular exchange reactions at high temperatures. The equilibrium constants were determined as a function of temperature by measuring the ion current intensities of the gaseous species as they effused from a Knudsen cell, which contained a mixture of two metal sulfides or a mixture of a pure metal and another metal sulfide or oxide. The effusion studies were made in the temperature range 2000° to 2500°K by means of a modified time-of-flight mass spectrometer. The effusion cell, of single-crystal tungsten, was heated by electron bombardment with temperatures controlled to within ± 2°C. Temperatures were measured by a calibrated optical pyrometer, sighted directly into the orifice through a shuttered window. The dissociation energies were calculated by both second and third-law methods; they are tabulated along with the selected "best" values for the dissociation energies. Dissert. Abstr.

N69-27067# Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.
KINETICS OF THE REACTION BETWEEN PLUTONIUM (3) AND CHLORINE IN SULPHATE SOLUTIONS
A. S. Ghosh Mazumdar and B. L. Gupta 1968 21 p
(BARC-379) Avail: CFSTI

The kinetics of the oxidation of plutonium (III) to plutonium (IV) by chlorine in sulphate solutions has been studied. Thermodynamic quantities of activation have been calculated from the experimentally determined activation energy of the reaction. Results are discussed and a mechanism is suggested. Author

N69-27068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE REACTIONS OF POLYAMIDES WITH EPOXY RESINS
M. M. Tamorutskii et al 22 Nov. 1968 18 p refs Transl. into ENGLISH from Akad. Nauk KazSSR, Izv. Ser. Khim. (USSR), no. 6, 1967 p 65–72
(AD-684020; FTD-HT-23-1099-68) Avail: CFSTI CSCL 7/3

It was found that the interaction of epoxy resins based on bis-phenol A with polyamides in various solvents leads to the formation of a soluble block copolymer. In the absence of a solvent, a block copolymer of a three-dimensional structure is formed. The soluble block copolymer contains reactive functional groups which cause the possibility of its becoming an insoluble and infusible substance. In the interaction of epoxy resins with alcohol-soluble polyamides and dicyandiamide it is possible to obtain a block copolymer film which can be used as adhesive material. Author (TAB)

N69-27087 Johns Hopkins Univ., Baltimore, Md.
STEADY STATE INTERFACIAL MASS TRANSFER WITH REACTION
Jost Otto Lutz Wendt (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16497

The steady state diffusion of both reacting solutes and also of slightly miscible solvents was studied in a newly designed diffusion cell, whose features are described in detail. An advantage of the steady state method is that a relatively simple interpretation of the data may be made for certain systems that cannot be treated analytically as unsteady problems, because of non linearities in reaction rates or non constant diffusion coefficients. A nonlinear model, which describes the transfer of a dimerizing substance through two phases, was developed. The model showed good agreement with the experimental data obtained from the diffusion cell. It was possible to interpret the data in terms of fundamental physical parameters, and to obtain a value of the diffusion coefficient of the dimer at infinite dilution. Disagreements in the literature on values of the equilibrium constant of the above reaction, and on the value of the distribution coefficient of the monomer between benzene and water were resolved. Dissert. Abstr.

N69-27088 Carnegie-Mellon Univ., Pittsburgh, Pa.
THERMODYNAMIC AND KINETIC STUDIES OF UREA-HYDROCARBON ADDUCTION
Wen-ching Yang (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-17624

The compositions of adduct in equilibrium with isopropanol solution containing known concentrations of urea and two competing n-alkanes (decane with either hexadecane or dodecane) were measured at 25°C using titration procedures. Instantaneous adduct compositions were independent of the urea and isopropanol concentrations and depend solely on the relative concentrations of the two hydrocarbons in the solution. Instantaneous adduct compositions were predicted using the copolymer equation with the two hydrocarbons considered as two comonomers and the ratio of the two equilibrium constants for the pure adducts play the same role in adduction as relative volatility does in distillation. Using a stopped-flow reaction, 188 kinetic runs were taken at 25°C on the hexadecane-decane-urea-isopropanol system with seed densities ranging from 0 to 2×10^5 particles/c.c. Dissert. Abstr.

N69-27105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH MOLECULAR CHELATES OF THE SCHIFF-BASE AND THEIR THERMOSTABILITY
Meng-Chun Tsao et al 13 Sep. 1968 16 p refs Transl. into ENGLISH from Chung Kuo K'o Hsueh (Peking), no. 9, 1965 p 53–58
(AD-683282; FTD-HT-23-567-68) Avail: CFSTI CSCL 7/2

The preparations of chelate polymers from acetylacetone (pentanedione-2, 4)chelate compounds of Ni(II), Cu(II) and Co(II) with bis-Schiff bases are reported. These polymer products are colored powders insoluble in benzene, ether, ethanol, and other common organic solvents. The molecular weight of these polymers has not been determined, in fact, they can not even be estimated by the use of elemental analysis data. Thermal stability of chelate compounds varies according to the various metals involved. Ni(II) chelates are stable above 360C. Cu(II) chelates have the lowest thermal stability and lose their weight at a temperature of 260C. The thermal weight-loss curves of Zn(II) and Cd(II) chelate polymers are more complicated. The thermal stability of chelate compounds also varies according to various monomers. TAB

N69-27129# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
SUBLIMATION OF A MONATOMIC ELEMENT
Ronald L. Kerber and Din-Yu Hsieh Jan. 1969 43 p refs
(Contract N00014-67-A-0094)
(AD-683710; Rept-85-45) Avail: CFSTI CSCL 7/4

A simple physical model is constructed to represent the sublimation of monatomic elements. According to this model, the solid and gas phases are two facets of a single physical system. The nature of the phase transition is clearly revealed and the relations between the vapor pressure, the latent heat, and the transition temperature are derived. The results are applied to the experimental data of argon, krypton, and xenon, with good agreement. Extension of the model to the melting transition is briefly discussed. Author (TAB)

N69-27132# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE NATURE OF THE REACTION OF SURFACE-ACTIVE SUBSTANCES WITH PIGMENTS AND FILLERS USING THE INFRARED SPECTROSCOPIC METHOD
A. V. Uvarov et al 18 Nov. 1968 15 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i ikh Primenanie (Leningrad), no. 2, 1967 p 14–18
(AD-684001; FTD-HT-23-603-68) Avail: CFSTI CSCL 7/4

Studied was the nature of the reaction of surface-active substances with pigments and fillers by infrared spectroscopy. Sorption of octadecylamine (I), stearic acid (II), Pb stearate (III), and Ca stearate (IV) on Al_2O_2, TiO_2, and SiO_2 was studied by IR spectroscopy. The compds. were sorbed in air or from Et_2O or PhMe solns. When absorbed from solns., I formed saltlike compds. with the sorbents. II, III, and IV were absorbed on SiO_2 and formed soaplike compds. with Al_2O_3 or TiO_2. III was more reactive than IV. III and IV decompd. on the surface of TiO_2 or Al_2O_3, giving IR spectra analogous to absorbed II. Author (TAB)

N69-27150 Delaware Univ., Newark.
THE REACTION OF PEROXIDE WITH OXIDANTS IN ALKALINE MEDIA
Harry Fredericks Bell (Ph.D. Thesis) 1968 227 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-17845

A study of reactions of hydrogen peroxide with several oxidants in alkaline media was carried out. Although hydroperoxide ion is commonly thought of as an oxidant, it may be oxidized by a number of reagents in alkaline solution including hypochlorite, periodate, and peroxyphosphonate. This work was undertaken to elucidate the mechanism of these peroxide-oxidant reactions, and to

evaluate the analytical utility of such systems. Many similarities were discovered in these reactions, but also striking differences. Electroanalytical, spectrophotometric, and titrimetric methods were employed throughout the investigation. The study demonstrated the importance of peroxy-intermediates in the reactions.
Dissert. Abstr.

N69-27209# Toronto Univ. (Ontario). Dept. of Chemistry.
INFRARED CHEMILUMINESCENCE AND ENERGY DISTRIBUTION IN CHEMICAL REACTIONS Final Report, 1 Apr. 1963–31 Mar. 1968
John C. Polanyi 10 May 1968 126 p refs Submitted for publication
(Contract AF 19(628)-2826)
(AD-683073; AFCRL-68-0599) Avail: CFSTI CSCL 7/5

Infrared chemiluminescence was studied in the reactive systems H + Cl2, H + Br2, H + HI, Cl + HI, Cl + HBr and Br + HI. Complete vibrational population-inversions have been maintained continuously, with resultant intermittent laser action. Some findings were (1) that the products of these reactions are formed in a broad bell-shaped distribution encompassing most of the thermodynamically accessible vibrational levels (2) that the mean vibrational excitation increases from H + Cl2 to H + Br2 to Cl + HI (3) that the peak vibrational-excitation in H + X2 is markedly less than in the alkali-metal-atom plus halogen reactions, and the peak translational excitation markedly greater. (4) There is some evidence from trajectory computations made in this laboratory that this difference (item (3)) correlates with a greater amount of repulsion between the newly-formed reaction products in the H + X2 reactions than in the M + X2. Infrared luminescence studies have for the first time directly demonstrated efficient electronic-to-vibrational energy-transfer ($Hg^* + CO,NO$). The document is comprised of 10 journal reprints.
TAB

N69-27219# Mound Lab., Miamisburg, Ohio.
STABLE GASEOUS ISOTOPE SEPARATION AND PURIFICATIONS: JULY–SEPTEMBER 1968
13 Feb. 1969 56 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1529) Avail: CFSTI

Research progress is reported on: separation of carbon isotopes; separation of stable isotopes of neon, argon, krypton, and xenon; transport properties and column properties in thermal diffusion; and ^3He distillation, superfluid separations, and thermal transpiration.
NSA

N69-27228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTRAL DETERMINATION OF NITROGEN IN TITANIUM AND ITS ALLOYS
S. A. Gorbunov et al 14 Nov. 1968 10 p refs Transl. into ENGLISH from Vop. Anal. Khim. Miner. Veshchestv. Leningrad. Gos. Univ. (Leningrad), 1966 p 88–94
(AD-684005; FTD-HT-23-640-68) Avail: CFSTI CSCL 11/6

Samples of pure Ti were oxidized at 800-1200C in an air atm. After cooling in air the sample was cut in 2 pieces: 1 part was used for hardness measurement of the layer saturated with gas, the 2nd one for emission spectral analysis with the help of electrical discharge. TiN and TiC were used as standards. Direct proportionality between the intensity of the spectral line and N concn. was assumed for the range of 0-22.6%. Results of the hardness measurement were in good agreement with the spectral data.
Author (TAB)

N69-27243# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
ISOLATION OF Am-241 FROM PLUTONIUM SCRAP BY EXTRACTION WITH TRICAPRYLMETHYLAMMONIUM NITRATE [ISOLIERUNG VON AMERICIUM-241 AUS PLUTONIUM-SCHROTT DURCH EXTRAKTION MIT TRICAPRYLMETHYLAMMONIUM NITRAT]
G. Koch and J. Schoan Jun. 1968 23 p refs In GERMAN
(KFK-783) Avail: AEC Depository Libraries

A method for the production of Am from scraps from preparation of plutonium-containing nuclear fuels was developed. The initial material is the americium-containing raffinate solution from the anion exchange column used for Pu recovery. From the solution concentrated by evaporation, the residual Pu and U were extracted with tricaprylmethylammonium nitrate (TCMAN) in an aromatic diluent. The aqueous solution freed of U and Pu was brought to 7M ammonium nitrate and to pH = 1.5 and the Am was extracted with TCMAN. The organic phase was washed with 7M ammonium nitrate. Am was re-extracted with 3M nitric acid, precipitated as the oxalate, and calcined to the oxide. The method was tested in the laboratory and yields a product of >99% purity. The Am loss was <2%.
Author (NSA)

N69-27245# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
DIRECT DETERMINATION OF URANIUM (6) WITH IRON (2) BY TITRATION AMPERE MEASUREMENT [DETERMINACION DIRECTA DE URANIO (6) CON HIERRO (2) POR TITULACION AMPEROMETRICA]
E. E. Garcia, M. Botbol, and J. Casabe 1968 13 p refs In SPANISH
(CNEA-241) Avail: CFSTI

The possibility of applying an amperage measurement to the titration procedure for determining the critical point in the reduction of uranium (6) to uranium (4) in iron is studied. A polographic approach to this system indicates the possible use of the anodic wave of the iron oxidation for the measurement. The significant parameters, affecting the procedure, are considered such as: type of electrode, method for titration, and treatments to minimize extraneous ions. The procedure as applied, yielded satisfactory results.
Transl. by F.O.S.

N69-27250# Atomic Power Development Associates, Inc., Detroit, Mich.
SOLUBILITY OF SODIUM CARBONATE IN SODIUM
H. T. Carmichael and S. A. Meacham Aug. 1968 24 p refs
(Contract AT(11-1)-865)
(APDA-184) Avail: CFSTI

Experiments were conducted to determine the solubility of sodium carbonate (Na_2CO_3) in liquid sodium at 150, 275, and 400°C. In the first phase of this work, undistilled commercial-grade sodium was used to qualitatively ascertain solubility, and in the second phase of experimentation, distilled sodium was used to conform with testing performed by other workers. The results of studies, using distilled sodium, indicated that the solubility of sodium carbonate in sodium is 24.4 ppM at 150°C, 37.9 ppM at 275°C, and 51.0 ppM at 400°C, with standard deviations of 4.8, 5.2, and 1.6, respectively.
Author (NSA)

N69-27282# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUANTITATIVE ANALYSIS OF P-PHTHALIC ACID BY INFRARED SPECTRUM
Chang-Chiang Chen et al 30 Sep. 1968 11 p refs Transl. into ENGLISH from Hua Hsueh Shih Chieh (Peking), v. 20, no. 3, 1966 p 128–130
(AD-683159; FTD-HT-233-574-68) Avail: CFSTI CSCL 7/4

A quantitative method is described for determining p-phthalic acid in synthetic resins, synthetic fibers, and plastifiers by infrared absorption spectrum. The apparatus used was a infrared spectrometer. Infrared absorption spectra of p- and o-phthalic acid in N, N-dimethyl formamide in varying concentrations from 5 mg to 25 mg/ml were spectrographed. Results showed that a p-phthalic acid absorption band peak occurred at 754/cm, and o-phthalic acid peaks at 819 and 769/cm. A linear relationship was shown when the value of log IO/I (relative intensity) was plotted against corresponding concentration. Experimental results also showed that o-phthalic acid had some effect on p-phthalic acid determination that when the spectrum of an unknown sample was compared with the knowns containing both p- and o-phthalic acid. TAB

N69-27294 Idaho Univ., Moscow.
THE PREPARATION AND REACTIONS OF N,N'-DIACYL-N,N'-DIALKOXYHYDRAZINES
Melvyn Wayne Mosher (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-16998

The oxidation of N-acyl-O-alkylhydroxylamines with a number of oxidizing agents was found to give a previously unreported class of compounds, N,N'-diacyl-N,N'-dialkoxyhydrazines. The oxidation agents that were found to accomplish this successfully were: lead tetraacetate, ammonium hexachloroplumbate and lead oxide. The decomposition reactions of N,N'-diacyl-N,N'-dialkoxyhydrazines were studied with acid, base, amines, halogens, stable free radicals, nitrogen oxides, and reducing agents. The following four mechanisms can be postulated in order to explain the reactions of the N,N'-diacyl-N,N'-dialkoxhydrazines with these reagents: electrophillic attack on alkoxy oxygen; nucleophilic attack on carbonyl carbon; free radial attack, and a four-center-concerted mechanism. Dissert. Abstr.

N69-27296# Kernforschungsanlage, Juelich (West Germany). Institut fuer Physikalische Chemie.
PHOTOCHEMICAL STUDIES ON AMMONIA AND AZIDES USING RADIO-GAS CHROMATOGRAPHY [PHOTOCHEMISCHE UNTERSUCHUNGEN AN AMMONIAK UND AZIDEN MIT HILFE DER RADIOGASCHROMATOGRAPHIE]
P. Tiedemann and R. N. Schindler Sep. 1968 51 p refs in GERMAN
(JUL-550-PC) Avail: CFSTI

A radio-gas chromatograph was designed and constructed for analyzing the photochemical decomposition of nitrogen-containing compounds. The experimental arrangements and the measuring methods are described. Sources of systematic and statistical errors are discussed. The photolysis of ammonia was studied in the presence of ethylene, and the reactions of the H atoms and the NH_2 radicals with the added ethylene were observed. Photochemical experiments with hydrazoic acid and methyl azide were conducted to obtain information on the reactivity of the biradicals NH and CH_2N. Transl. by K.W.

N69-27302# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DBBP SOLVENT EXTRACTION RECOVERY OF NEPTUNIUM AND PLUTONIUM FROM PUREX 1WW SOLUTION
W. W. Schulz Feb. 1969 47 p refs
(Contract AT(45-1)-1830)
(BNWL-702) Avail: CFSTI

A batch solvent extraction process was developed to recover neptunium and plutonium values from Hanford Purex process 1WW solution. Dibutylbutyl phosphonate (DBBP) diluted with a mixture of normal paraffin hydrocarbons is used as the extractant. The utility and feasibility of the DBBP extraction process were fully demonstrated in laboratory scale tests with both synthetic and plant 1WW solutions. Plant scale tests of the process for possible eventual incorporation into the Hanford Purex process complex are recommended. Author (NSA)

N69-27304# Southampton Univ. (England). Dept. of Chemistry.
INFRARED SPECTROSCOPY APPLICATION TO CHEMICAL KINETIC SYSTEMS Final Report, 1 Jun. 1965–30 Sep. 1968
Neville Jonathan Oct. 1968 2 P refs
(Contract AF 61(052)-886)
(AD-683772; AFCRL-69-0055) Avail: CFSTI CSCL 7/4

The development of a fast sorption pump which it is believed will be of considerable use in gas kinetic studies, is reported. The results are given of studies on three light emitting reactions, viz. atomic oxygen plus nitric oxide, atomic nitrogen recombination, and atomic oxygen plus acetylene. The mechanism by which ozone is adsorbed on silica gel has been investigated using infrared absorption spectroscopy. It is believed that the ozone is rendered comparatively unreactive as a result of strong hydrogen bond formation with the surface OH groups. Author (TAB)

N69-27305# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF ACTIVE GASES ON THE ELECTROPHYSICAL PROPERTIES OF THE SURFACE OF SILICON
V. A. Arslambekov et al 14 Nov. 1968 12 p refs Transl. into ENGLISH from the publ. "Simpozium po Elektronnym Protsessam na Poverkhnosti i v Tonkikh Monokristallicheskikh Sloyakh Poluprovodnikov" Novosibirsk, Izd. Nauka Sibirskoye, 1967
(AD-684014; FTD-HT-23-622-68) Avail: CFSTI CSCL 7/4

The purpose of the investigation was to compare the electrophysical properties of a pure silicon surface with a surface coated by the film produced during chemical etching. The tests were made on n-type single-crystal silicon cut along the (111) plane and polished with corundum. The tests were made in atmospheres of air, hydrogen fluoride, gaseous fluorine, and other gases, and also in vacuum. Most experiments were performed at room temperature. The rate of surface recombination of the minority carriers was determined from the relaxation time of the photoconductivity after elimination by short light pulses from a flash lamp especially constructed for the purpose. The results showed that the etching reduces the surface recombination as result of the increased number of defects produced by the film. The causes for differences between the effects of different gases are explained. TAB

N69-27317# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
METHODOLOGY FOR ANALYZING URANIUM ISOTOPES WITH A PRECISION WITHIN 0.1% [METODOLOGIA DI ANALISI ISOTOPICHE DI URANIO PER PERCISIONI INTORNO ALLO 0.1%]
F. Pozzi 1968 20 p refs In ITALIAN Presented at 1st Conf. of Mass Spectrometrie, Ispra, 29–30 Apr. 1968
(RT/CHI/68/39) Avail: CFSTI

A method for analyzing uranium by mass spectrometry using surface ionization is presented. Various parameters effecting the procedure are examined in detail. These parameters such as pH of the solution, and ion emission are divided into two phases: (1) preparation and chemical state of the sample, and (2) experimental conditions of the analysis. It is concluded that in the preparation phase, the pH of the sample must be controlled, and in the production of ions, the temperature must also be controlled. Transl. by F.O.S.

N69-27336# California Univ., Davis. Dept. of Chemistry.
RECOIL STUDIES IN CHEMICAL DYNAMICS Progress Report, 1 Jan.–31 Dec. 1968
31 Dec. 1968 11 p
(UCD-34-P-158-1) Avail: CFSTI

Reactions of recoil tritium and recoil ^{18}F with 1,1,1-tri-fluoroethane were studied. Both processes led to hot molecules, which then undergo pressure-dependent unimolecular decomposition to 1,1-difluorethylene. It was concluded that recoil fluorine reacts at much higher energies than recoil tritium. Reactions of recoil ^{18}F with cyclo-C_4F_8 and cyclo-C_3F_6 were also studied. Recoil experiments with n-perfluoralkanes demonstrated that no F for F abstraction takes place, that F for F substitution does take place probably at high energies, and F for perfluoroalkyl radical reactions are more important than the analogous reactions in the tritium–hydrocarbon systems. It is shown that the $^{23}Na(n,2n)^{22}Na$ reaction can be used to monitor the production of ^{18}F in recoil experiments. NSA

N69-27358# Windsor Univ. (Ontario). Dept. of Physics.
INELASTIC COLLISIONS BETWEEN EXCITED ALKALI ATOMS AND MOLECULES. 6: SENSITIZED FLUORESCENCE IN MIXTURES OF SODIUM WITH CH_4, Cd_4, C_2H_2, C_2H_4, and C_2H_6
M. Stupavsky and L. Krause Jan. 1969 17 p refs
(Contract N00014-67-C-0538; ARPA Order 125)
(AD-683796) Avail: CFSTI CSCL 7/4

The total cross sections for 3 doublet P1/2 to 3 doublet P3/2 mixing in sodium, induced in collisions with CH4, CD4, C2H2, C2H4 and C2H6 molecules, have been determined using the method of sensitized fluorescence. The sodium vapor - molecular gas mixtures were irradiated with each Na(D) component in turn, and the cross sections were obtained from measurements of relative intensities of the two D-components present in the fluorescent light. Author (TAB)

N69-27374# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECTS OF FINE PRECIPITATES ON CRITICAL CURRENT DENSITIES OF SUPERCONDUCTING NIOBIUM 1% ZIRCONIUM
Meseki Suenaga (Ph.D. Thesis) Jan. 1969 58 p refs
(Contract W-7405-eng-48)
(UCRL-18536) Avail: CFSTI

A simple model for flux pinning by nonsuperconducting precipitates was developed and was compared with the experimental results on Nb–1% Zr alloy. The model predicted that critical current densities, J_c, were approximately proportional to $(b/\delta)^{3/2}$ $(J/2\kappa^2-1)^{1/2}$ $(H_{c2}-H/H)$ for $b << \delta$ where 2b is the diameter of precipitate, 2δ is the interparticle space, J is the energy of a flux line, κ is the Landau–Ginzburg constant, H_{c2} is the upper critical field of the alloys, and H is the applied field. The magnetic field dependence of J_c was in good agreement with experimental results in the cases of intermediate pinning strength. But, for very weak or strong pinning strength, departure of experimental and theoretical results was noted at higher fields. Although it was very difficult to determine exact slopes of a plot ln $[J_c/(b)^{3/2}]$ vs ln δ due to experimental scatter in measured b and δ, the size and the spacing dependence of J_c was thought to be reasonably consistent with the experimental results in spite of simplifying assumptions used in the model. Author (NSA)

N69-27382# Oak Ridge National Lab., Tenn.
INTERACTIONS IN ALKALI METAL SOLUTIONS CONTAINING OXYGEN. 1: THE NIOBIUM–OXYGEN–POTASSIUM SYSTEM
R. L. Klueh Feb. 1969 28 p refs Presented at the Natl. Assoc. of Corrosion Engr., Cleveland, 18–21 Mar. 1968
(Contract W-7405-eng-26)
(ORNL-TM-2476; CONF-680313-3) Avail: CFSTI

As an alternative to the ternary oxide hypothesis, which assumes that dissolution of refractory metals increase drastically when alkali metals contain oxygen, studies were made on the possibility that at equilibrium only two condensed phases are present and that the oxygen affects the solubility of the refractory metal by decreasing the activity coefficient of the refractory metal in the liquid. The interplay between solute species in refractory metal–oxygen–alkali metal systems can be characterized in terms of interaction parameters as developed by Wagner. This approach was evaluated using data from the niobium–oxygen–potassium system at 600°C. The observed solubility of niobium as a function of the oxygen content in potassium was consistent with that expected on the basis of calculated interaction parameters. Analysis of the observed behavior in terms of the phase rule also indicated that only two condensed phases exist at equilibrium. NSA

N69-27417# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETECTION OF A CAPTURED ELECTRON IN IRRADIATED FROZEN AQUEOUS SOLUTIONS OF ALKALIS BY THE ELECTRON PARAMAGNETIC RESONANCE METHOD
B. G. Ershchov et al 16 Feb. 1968 14 p refs Transl. into ENGLISH from Akad. Nauk LatSSR, Inst. Fiz. Radiats. Fiz. (Latvia), no. 4, 1966 p 39–47
(AD-683277; FTD-MT-24-10-68) Avail: CFSTI CSCL 7/5

In earlier work the hydrated electron produced by the effect of ionizing radiation on water was detected with the aid of EPR. The present study was made on frozen solutions, for which the probability of the hydrated electron is the largest. The EPR solutions of NaNO3 irradiated at 77K, and of concentrated solutions of KOH, irradiated at 77K, are analyzed and the radicals responsible for the different fine structure lines are identified. The measured line widths and the corresponding g-factors, as well as data obtained by others, lead to the conclusion that in the radiolysis of water and aqueous solutions, the primary radiolysis product, which has reducing properties, is the hydrated electron, which becomes stabilized in alkaline solutions at low temperatures. The character of its EPR spectrum indicates that the nearest neighboring of the electron are water molecules and not cations. The nature of the observed paramagnetic center is discussed in light of these results and published data. Author (TAB)

N69-27420# Michigan State Univ., East Lansing.
NUCLEAR CHEMISTRY Annual Report, 1968
Wm. C. McHarris 1968 71 p refs
(Contract AT(11-1)-1779)
(COO-1779-4) Avail: CFSTI

The decays of Fe-53, Zn-62, Zn-63, Gd-145g,m, Gd-147, Gd-149, Yb-167, Pb-200, Pb-203m, Bi-205 and Es-252 were investigated. Information on the isomeric states and on states in daughter nuclei was obtained. A PDP-9 computer was put into operation as a multichannel analyzer. A coincidence system for two-dimensional γ-ray spectroscopy was developed, and programs for manipulation of the data were developed. Methods for separating Gd from Eu and Sm were developed, as was a fast target changer for studies of short-lived isotopes. Development of an on-line isotope separator for the cyclotron facility was begun. NSA

N69-27421# Maryland Univ., College Park. Dept. of Chemistry.
RESEARCH IN NUCLEAR CHEMISTRY AT THE UNIVERSITY OF MARYLAND Progress Report, 1968
V. E. Voila, Jr. Nov. 1968 11 p refs
(Contract AT(40-1)-3783)
(MNC-3783-2) Avail: CFSTI

The angular, kinetic energy, and mass distributions of heavy fragments from proton reactions with ^{238}U at 13 GeV/c were measured. Angular distributions of heavy fragments from proton reactions with ^{238}U at energies of 5 to 13 GeV/c were also measured. Mass predictions for elements with $A \geq 140$ by extrapolation of the observed energy systematics for β and α decay were studied; and semiempirical relations for predicting the half-lives of heavy elements for α decay, β decay, and spontaneous fission were formulated. The production of nuclides with $A > 250$ in stellar nucleosynthesis was studied theoretically. The nuclear decay properties of very heavy elements were examined in order to investigate the apparent instability for nuclides with $N \geq 158$. NSA

N69-27441# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
HIGH-TEMPERATURE EVAPORATION AND THERMODYNAMIC PROPERTIES OF CM_2O_3
P. K. Smith and D. E. Peterson 8 March 1968 34 p refs
Presented at the 155th Natl. Meeting of the Am. Chem. Soc., San Francisco, 31 Mar.–4 Apr. 1968
(DP-MS-67-110; CONF-680308-16) Avail: CFSTI

$CmO_{1.50}$ vaporizes congruently primarily to gaseous atoms. The heat and entropy of vaporization over the range 1800 to 2600°K are 665 ± 13.5 kcal/mole and 167.5 ± 6.0 eu, respectively. The Third Law and Second Law ΔH are 678.5 ± 8.0 and 670 ± 10 kcal/mole, respectively. The melting point of Cm_2O_3 is above 2600°K. The heat of formation of $Cm_2O_3(s)$ at 0°K is −443 ± 18 kcal/mole. The dissociation energy of CmO(g) is less than 5.8 eV. Author (NSA)

N69-27444 Kansas State Univ., Manhattan.
STUDIES IN FLAME SPECTROSCOPY. PART 1: A SIMPLE DEMOUNTABLE HOLLOW CATHODE FOR ATOMIC ABSORPTION SPECTROSCOPY. PART 2: THE ATOMIC ABSORPTION CHARACTERISTICS OF GERMANIUM, GALLIUM, AND INDIUM. PART 3: THE EFFECTS OF PHOSPHATE, SULFATE, AND ALUMINUM ON THE FLAME SPECTROSCOPIC DETERMINATION OF THE ALKALINE EARTH METALS, CALCIUM IN PARTICULAR
Ronald Edwin Popham (Ph.D. Thesis) 1968 203 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-17525

From the components of a previously burned out commercial hollow cathode, a demountable hollow cathode of very simple construction and operation was made. The performance of the demountable lamp for the determination of Zn, Ni, and Cr by atomic absorption was comparable to that of commercial lamps. Germanium, Ga, and In cathodes were prepared for the demountable hollow cathode, and the atomic absorption characteristics of these metals were determined. Germanium could be determined at the 2651.18 to 2651.58 Å doublet with a detection limit of 0.5 ppm. Gallium was determined with maximum sensitivity at the 2943.64 to 2944.18 Å doublet in an aqueous solvent system with a premix, fuel-lean nitrous oxide-acetylene flame. Maximum sensitivity for In was obtained at 3256.09 Å in an aqueous solvent system with a premix, fuel-lean air-acetylene flame. With both total consumption and laminar flow burners and C_2H_2/air, C_2H_2/O_2, C_2H_2/N_2O, and H_2/O_2 flames, a detailed study of the effects of PO_4^{-3}, SO_4^{-2}, and Al as $AlCl_3$ and $Al(NO_3)_3$, on the flame spectroscopic behavior of Ca was made. Dissert. Abstr.

N69-27469# Japan Atomic Energy Research Inst., Tokyo.
RADIATION-INDUCED POLYMERIZATION OF VINYL ETHERS
Tsutomu Naruse (Nagoya Univ.), Kenji Fueki (Nagoya Univ.) and Zen-ichiro Kuri (Nagoya Univ.) Dec. 1968 13 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), no. 70, Apr. 1967 p 580–583
(NSJ-tr-142) Avail: AEC Depository Libraries

In order to clarify the mechanism of radiation polymerization of vinyl ether, various vinyl ethers were studied. The polymerization was carried out at 25°C for the ordinary dehydrated and the completely dehydrated systems. In the ordinary dehydrated system, the polymerization velocity was little influenced by an ion-take-up agent such as NH_3, but was remarkably reduced by a radical inhibitor. This gave evidence for the radical mechanism. For the completely dehydrated system, n-butylvinyl ether was studied. The G(−M) was about 25 times larger than that of the ordinary dehydrated system, showing a remarkable increase in the polymerization velocity. Addition of low concentration of NH_3 or CH_3OH inhibited the polymerization considerably. These results indicated a cation mechanism by a free ion. From the results of the NH_3-added system, $k_p = 8.4 \times 10^7 M^{-1} sec^{-1}$ was obtained as the growth-velocity constant at 250°C. NSA

N69-27492# Atomic Energy Establishment, Winfrith (England).
INTERFERENCE BETWEEN EXPANDING SODIUM VAPOUR BUBBLES
A. M. Judd Sep. 1966 20 p refs Sponsored by US-Euratom Fast Reactor Exchange Program
(AEEW-M-793; FRPC/RSWP/P-(66)119) Avail: CFSTI

A method is used to calculate the expansion of large numbers of neighboring vapor bubbles in superheated liquid sodium, when the expansion of each individual bubble is retarded by the presence of the other bubbles. A model involving many identical bubbles is used for the main calculations, and this is checked by calculations using a model with two bubbles of different sizes. The accompanying pressure transients are also calculated. Author (NSA)

N69-27509# Massachusetts Inst. of Tech., Cambridge.
NON-EQUILIBRIUM EFFECTS IN CHEMICAL KINETICS
John Ross Jan. 1969 20 p refs
(Contract N00014-67-A-0226; Proj-Squid)
(AD-683806; MIT-48-PU) Avail: CFSTI CSCL 7/4

The analysis of non-equilibrium effects in chemical rates requires solutions of appropriate transport equations. Discussed is a simple way of obtaining the Boltzmann equation of transport, including bimolecular reactions in a gas at low density and Chapman-Enskog type solutions for this equation and their consequences for chemical kinetics. TAB

N69-27510# Brookhaven National Lab., Upton, N.Y.
MACROMOLECULES. ELECTRONIC MICROSCOPY OF THE RADIOCHEMICAL POLYMERIZATION OF TETRAOXANE MONOCRYSTALS
Christian Cannavo et al [1968] 8 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 266 (Ser. C), 11 Mar. 1968 p 777–780
(BNL-tr-256) Avail: CFSTI

This technique under vacuum at low temperature made it possible to follow the formation of the polymer in the interior of the monomeric crystal and its development in the form of oriented fibrils. Author (NSA)

N69-27511# Aerojet-General Corp., San Ramon, Calif. Nuclear Div.
ALKALI METALS EVALUATION PROGRAM. THERMODYNAMIC AND TRANSPORT PROPERTIES OF RUBIDIUM. THERMAL CONDUCTIVITY OF THE VAPOR
P. Y. Achener and J. T. Jouthas Oct. 1968 73 p refs
(Contract AT(04-3)-368)
(AGN-8192-Vol-2) Avail: CFSTI

Results of investigations are reported in which the thermal conductivity of rubidium vapor at temperatures from 824° to 1127°K at pressures from 0.208 to 3.71 atm with superheat ranging from 1 to 40°K, and of cesium vapor at temperatures from 838° to 1037°K at pressures from 0.265 to 2.13 atm with superheat ranging 11° to 52°K was determined. The heat transfer to laminar flow method was used to generate the experimental data. The tests were performed with a specially designed apparatus, fabricated from Nb–1% Zr alloy, which consisted of two boilers, a superheater, a test section (including a thin circular tube in which the measurements were performed), a condenser and a flow measuring device. Author (NSA)

N69-27569# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLUORINATED POLYBENZIMIDAZOLES. 2
R. M. Gitina et al 30 Jul. 1968 10 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), ser. B, v. 9, no. 6, 1967 p 447–452
(AD-683541; FTD-HT-23-381-68) Avail: CFSTI CSCL 7/3

The paper describes the synthesis and properties of poly-N, N-dimethyl- and poly-N, N-diphenyl-2, 2-perfluorotrimethylene-5, 5-dibenzimidazoles and their hydrogen analogs, obtained respectively by condensing diphenyl esters of perfluoroglutaric and glutaric acids with 4, 4-bis(methylamino)-3, 3-diaminodiphenyl and 4, 4-dianilino-3, 3-diaminodiphenyl. It was found that the thermal stability (in a vacuum) of polyperfluorotrimethylene-5, 5-dibenzimidazole does not increase upon methylation at the nitrogen atom, but does increase considerably upon phenylation. In thermal stability in a vacuum, poly-N, N-diphenyl-2, 2-perfluorotrimethylene-5, 5-dibenzimidazole slightly surpasses poly-N, N-dimethyl-2, 2-trimethylene-5, 5-dibenzimidazole. Poly-N, N-diphenyl-2, 2-perfluorotrimethylene-5, 5-dibenzimidazole and poly-N, N-dimethyl-2, 2-trimethylene-5, 5-dibenzimidazole also were found to be the most stable compounds under conditions of thermal-oxidative degradation. TAB

N69-27583# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
KINETICS OF HOMOGENEOUSLY CATALYZED GAS-LIQUID REACTIONS; CHLORINATION OF BENZENE WITH STANNIC CHLORIDE CATALYST
Bernard Silberstein, Harding Bliss and John B. Butt Jul. 1968 50 p refs
(Grant NSF GK-1014)
Avail: Issuing Activity

A method for measuring the rates of reaction between a liquid and a reactant gas dissolved in it is described, and the kinetics of benzene chlorination homogeneously catalysed by stannic chloride have been measured using the method. The kinetics of benzene chlorination are best interpreted in terms of a mechanism which postulates the rate controlling step to be the reaction between stannic chloride and a π-complex of chlorine and benzene. The reaction is shown to be first order in free (uncomplexed) benzene, in free (uncomplexed) chlorine, and in stannic chloride. Heterogeneous runs in which chlorine is passed through the benzene–catalyst phase are also described. A simple model in which a conventional chlorine transport rate is superimposed on the homogeneous kinetics is shown to correlate very well the conversion time behavior found experimentally. While diffusional limitations restrict the rate of reaction, selectivity or product distribution in such heterogeneous systems is not affected. Author

N69-27598# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
DETERMINATION OF INTERFACIAL AREA WITH SLOW CHEMICAL REACTIONS
Bernard Silberstein, John B. Butt, and Harding Bliss Apr. 1968 23 p *Its* Revision
(Grant NSF GK-1014)
Avail: Issuing Activity

A technique for measuring interfacial areas in a semiflow batch reactor using a slow chemical reaction is described. The experiment requires unsteady operation of the reactor until concentration of gaseous reactant dissolved in the liquid phase reaches a quasi steady-state value. Concentration data from both transient and steady-state periods of operation are employed to determine both volumetric mass transfer coefficient and interfacial area. The method is applied to benzene chlorination with stannic chloride catalyst. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-28155# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IONOSPHERIC WAVEGUIDE DUCTS FOR LONG-RANGE RADIO COMMUNICATION BELOW THE MAXIMUM OF THE F_2 LAYER
V. A. Danalin 2 Jul. 1968 18 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 5, no. 2, 1967 p 231–239
(AD-683125; FTD-HT-23-483-68) Avail: CFSTI CSCL 17/2.1

The waveguide theory approach to the propagation of radio waves explains (1) the slow drop of the satellite field intensity at a long distance from the receiving point, (2) the antipode effect in the earth-ionosphere waveguide and (3) the reception of signals from a satellite on the surface at frequencies higher than MVF. For above-surface waveguides in the far zone, the field intensity is determined by signals whose paths are located above the strongly absorbing ionospheric layers. Conditions for the lower end of the ultrashort-wave band are especially favorable because for this band the waveguide is located in the region of the maximal electron-concentration gradient in the F2-layer. The stability of the F2-layer in respect to various geophysical factors leads to the assumption that there is a continuous ionospheric duct which permits communication over large distances. TAB

N69-28202# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXACT AND APPROXIMATE BOUNDARY CONDITIONS IN THE THEORY OF ELECTROMAGNETIC WAVE PROPAGATION
G. N. Krylov et al 2 Aug. 1968 18 p refs Transl. into ENGLISH from Probl. Difraktsii i Rasprostraneniya Voln (Leningrad), no. 5, 1966 p 85–96
(AD-683098; FTD-HT-23-484-68) Avail: CFSTI CSCL 20/14

The paper deals with the methods of investigating waves propagated above the earth. Such a problem generally requires different degrees of approximation of conditions existing on the earths surface. The present discussion is based on the assumption that the earth surface can be approximated as being flat. The Hertz vector is used for the solution of the problems relating to the theory of electromagnetic wave propagation. Two transformations relating the Hertz vector to vectros of electric and magnetic fields are given. A vertical electric dipole is located in space as the next step and the conditions of the interphase surfaces are then formulated. Construction of precise and approximate solutions is discussed for two locations of the dipole: one in the upper half-space and the other in the lower half-space. Two methods of selecting proper constants are reviewed. Author (TAB)

N69-26207# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STATISTICAL PROPERTIES OF RADAR SIGNALS FROM SURFACES IN SYSTEMS WITH INTERNAL COHERENCE

V. V. Tsvetnov 6 Aug. 1968 25 p refs Transl. into ENGLISH from Tr. Teoriya i Tekhn. Radiol. Sb. Statey (Moscow), no. 1, 1966 p 5–26

(AD-683139; FTD-HT-23-487-68) Avail: CFSTI CSCL 17/7

The article examines the statistical properties of beat signals in radar systems with inner coherence under conditions where the signal is reflected from extended rough surface. The power spectrum, autocorrelation function, and other statistical characteristics have been found by the phenomena-logical-modeling method. The general solution is valid for a broad class of emitted continuous-type signals and is exemplified by an illustration of the Doppler velocity meter with monochromatic radiation and of a radio altimeter with frequency modulation. TAB

N69-26272*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIO FREQUENCY INTERFERENCE EXPERIMENT DESIGN FOR THE APPLICATIONS TECHNOLOGY SATELLITE

Varice F. Henry and John J. Kelleher Washington May 1969 15 p refs

(NASA-TN-D-5041) Avail: CFSTI CSCL 17B

The proposed experiment described herein is designed to measure and evaluate the amount of mutual interference between communications-satellite and terrestrial microwave relay systems at the shared common carrier frequency bands of 6 and 4 GHz. It is proposed to measure terrestrial-to-satellite interference at 6 GHz and satellite-to-terrestrial interference at 4 GHz. To meet the technical requirements of this experiment, it is necessary to utilize a satellite of the type planned for the ATS F and G program. These spacecraft, each carrying a 30-foot parabola as the prime antenna, will be capable of 0.1-degree pointing accuracy and full earth-scanning coverage. Measurements will be made of several parameters to obtain a fuller understanding of existing conditions related to such interference. Parametric measurements will include transmitted and received power levels, propagation-path loss and variations as a function of range, elevation angle, RF polarization, and geographical location of interference sources. Author

N69-26273*# Ohio State Univ., Columbus.

SLOPE DIFFRACTION ANALYSIS OF TEM PARALLEL-PLATE GUIDE PATTERNS

D. C. F. Wu and R. C. Rudduck Washington NASA May 1969 52 p refs

(Grant NGR-36-008-005)

(NASA-CR-1326; TR-1691-29) Avail: CFSTI CSCL 09E

The radiation pattern of a TEM mode parallel plate waveguide is analyzed by wedge diffraction theory in conjunction with a slope correction term. This slope correction term is the diffraction by a conducting wedge due to an incident wave with sinusoidal amplitude variation over the wave front. Such a wave is referred to as a slope wave. The slope diffraction takes into account the nonuniform wave in calculating second order diffractions for the open ended guide. The slope correction term provides an improvement in the accuracy of the pattern in the region near the plane of the aperture as compared to the previous wedge diffraction calculations. Author

N69-26356*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.

A SPACE COMMUNICATIONS STUDY Status Report, 15 Dec. 1968–15 Mar. 1969

Donald L. Schilling, Kenneth K. Clarke, and Raymond L. Pickholtz 15 Mar. 1969 16 p refs

(Grant NGR-33-006-020)

(NASA-CR-101126) Avail: CFSTI CSCL 17B

Harmonic distortion in the frequency demodulator using feedback (FMFB) is considered. A closed form solution for the harmonic distortion was obtained, and an expression for the intermodulation distortion is being determined. Delta modulation, a technique of transmitting an analog signal by first encoding the signal into binary digits, is discussed, with descriptions of the transmitter and receiver included. In the area of recursive signal processing techniques, two significant advances were made: an extension of previous work on the recursive detection of known signal in noise, and the development and analysis of a new iterative algorithm for optimization. A program investigating the effects of multipath fading upon the operation of threshold extending FM receivers is underway. P.A.B.

N69-26408*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.

A STUDY OF DIGITAL TECHNIQUES FOR SIGNAL PROCESSING Final Status Report, 1 Jul 1968–31 Jan. 1969

Mischa Schwartz and Robert R. Boorstyn 31 Jan. 1969 19 p refs

(Grant NGR-33-006-040)

(NASA-CR-101135) Avail: CFSTI CSCL 17B

Three areas in the general field of digital processing of signals are presented. These fields include recursive techniques for digital signal processing, data smoothing and compression, and computer simulation of low error rate communication systems. Continuation of recursive techniques, continuation of optimal adaptive control for data compression systems, adaptive equalizers for digital transmission, and signal zero-crossings as information carriers in communication systems are discussed in detail. The detection of binary signals in colored noise with numerator dynamics is discussed and showed that the resultant detector consists of a Kalman filter followed by recursive generation of the likelihood ratio. Author

N69-26433*# Goodyear Aerospace Corp., Akron, Ohio.

ADVANCED PASSIVE COMMUNICATION SATELLITE SYSTEMS COMPARISON STUDIES. VOLUME 1: SUMMARY Final Report

J. Roth, R. D. Ray, E. J. Roth, and B. R. Stack (Stanford Research Inst.) Apr. 1969 68 p refs

(Contract NAS5-10295)

(NASA-CR-101116; GER-1403-Vol-1) Avail: CFSTI CSCL 17B

This study compared, primarily on an economic and operational basis, advanced active and passive satellite communication systems for the purpose of establishing the relative merits of advanced passive systems. The material covered is unique from that covered by previous studies in that passive reflectors in synchronous orbit are considered, and detailed comparison on the basis of system costs are included. Representative passive and active communication satellite systems for the early 1970's were postulated, based on a survey of existing and near future capabilities. A cost comparison

was made using a cost model developed for the program and considering two representative missions among some of the many possible depicted. The comparison was tempered by a consideration of the relative operational performance, effectiveness, and utility of the two system types. Conclusions were drawn for the specific cases evaluated and guidelines for extension to more general cases are provided. Author

N69-26434*# Goodyear Aerospace Corp., Akron, Ohio.
ADVANCED PASSIVE COMMUNICATION SATELLITE SYSTEMS COMPARISON STUDIES. VOLUME 2: TECHNICAL DISCUSSION Final Report
J. Roth, R. D. Ray, E. J. Roth, and B. R. Stack (Stanford Research Inst.) Apr. 1969 169 p refs
(Contract NAS5-10295)
(NASA-CR-101117; GER-14303-Vol-2) Avail: CFSTI CSCL 17B

This program reviewed recent advances and combined new technologies to establish for the 1970 time period, a state of the art, feasible, advanced passive communication satellite system for synchronous orbit. This system was then compared against an appropriate advanced active communication satellite system. The results presented represent the most up to date analysis of the comparative effectiveness of active and passive satellite systems. They are considered unique in connection with the study of systems utilizing passive reflectors in stationary orbit since no previous studies of such systems have been performed. A summary is presented of each of the major components which comprise an active and/or passive communication satellite system. These areas contain state of the art and projected near future capabilities along with their associated costs. Author

N69-26435*# Goodyear Aerospace Corp., Akron, Ohio.
ADVANCED PASSIVE COMMUNICATION SATELLITE SYSTEMS COMPARISON STUDIES. VOLUME 3: APPENDICES Final Report
Apr. 1969 381 p refs
(Contract NAS5-10295)
(NASA-CR-101118; GER-14303-Vol-3) Avail: CFSTI CSCL 17B

A design description of the saddle reflector is presented, including possible packaging arrangements, deployment sequences and mechanisms and weight estimates. In addition, the results of a preliminary structural analysis are discussed and the surface deviations due to typical stimuli in orbit are considered. The analyses were completed utilizing a reflector with an equivalent 400 foot diameter aperture, prior to the selection of the 325 foot reflector discussed in the report. The design analysis effects were not within the scope of the subject program, and were completed in connection with other efforts. However, the results pertaining to the saddle design are pertinent, warranting their inclusion in this report. Author

N69-26490 Carnegie-Mellon Univ., Pittsburgh, Pa.
A DISPERSIVE DELAY NETWORK USING NEGATIVE PARAMETERS
Richard Joseph Ravas (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-17639

A dispersive delay network using negative impedance elements is developed. Practical applications are demonstrated by digital computer simulation using an analog language; to improve program efficiency, superposition was employed rather than direct solutions to various complex inputs. Results are given for applications of the network in pulse compression radar and in scanning radio frequency spectrum analyzers. Dissert. Abstr.

N69-26498# Consiglio Nazionale delle Ricerche, Rome (Italy). Istituto Nazionale di Ultracustica O. M. Corbino.
ON THE CRITERIA OF ESTIMATING NOISE DISTURBANCE [SUI CRITERI DI VALUTAZIONE DEL DISTURBO DA RUMORE]
I. Barducci Dec. 1967 54 p refs In ITALIAN
(INUA-5) Avail: CFSTI

Several examples of the principle methods of evaluating noise levels are compared. The cases analyzed confirm the actual level indices for noise perception, speech interference, qualitative scales, and resonance. Two of the methods are different procedures for computing the same index: the level equivalent in phon, and information on the noise intensity. The dB measurements furnish information as to the source of the noise. It is suggested that more comparative experimental data are required to arrive at a simple global system of indices for measuring noise spectra. Graphs and tables correlating the noise data are included. Transl. by F.O.S.

N69-26579# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEM OF COMMUNICATION WITH INTERPLANETARY SPACE VEHICLES
Yu. K. Khodarev 19 Aug. 1968 6 p Transl. into ENGLISH from Russian Rept. Presented at the 18th Intern. Astronautical Congr., Belgrade, 1967
(AD-683093; FTD-HT-23-790-68) Avail: CFSTI CSCL 17/2.1

A communications system used during deep-space probes (Zond, Mars, and Venera) is described. The equipment in the Deep-Space Communications Center (usually one point) provides communications for all deep-space probes. Communication is periodic and scheduled. When the interval between communication-exchange sequences is long enough (15 days), receiver tuning problems arise because of the Doppler frequency shift and signal delay. To avoid these problems, deep-space communications systems in the USSR have a programmed control for correcting the ground-based transmitter and receiver (heterodyne) frequencies. This control uses the real-time parameters from the space-flight trajectory and velocity. The control system determines the difference between measured and predicted system frequency and signal-delay time. The accuracy of the frequency control is about 0.25 Hz with a phase shift of 1--2 degrees, and the accuracy of signal-delay time is 1--2 msec. A noncoherent detector is used in the space receiver because the ground transmitter imparts about 100 kw of power to the antenna. The ground receiver has a coherent receiver, and the message from space is modulated by a code-FM-PM or code PM-PM system. Practical use of the communication system described shows that it provides communication without additional receiver-frequency adjustment and is recommended for use in deep-space communications. Author (TAB)

N69-26585 University of Southern Calif., Los Angeles.
FOURIER CODING OF IMAGES
Harry Charles Andrews (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-17010

The transmission of two-dimensional images over large distances from far ranging space probes has become an important factor in space exploratory research. A common requirement for such transmission systems is a large bandwidth, low noise interference communication link for pleasing reception. Standard communication systems transmit images as they are normally viewed by light sensing devices such as cameras, photosensitive emulsions, and the human eye. This thesis presents the results of investigations into the feasibility of transmitting the Fourier transform of an image rather than the spatial domain representation. The Fourier transform tends to compact the image energy in the Fourier domain such

that large bandwidth reductions can be obtained. Noise energy introduced in the Fourier domain tends to spread over the entire retransformed image, and thus becomes less offensive to the eye.
Dissert. Abstr.

N69-26836# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF THE OPTIMAL OPERATING FREQUENCIES FOR COMMUNICATION BY REFLECTION FROM THE F2 LAYER WITH THE USE OF THE FUNCTION OF COMMUNICATIONS ENSURANCE
Yu. G. Mizun 23 Aug. 1968 17 p refs Transl. into ENGLISH from the Publ. "Vysokoshirotnye Issledovaniya v Oblasti Geomagnetizma i Aeronomii" Moscow, Izd. Nauka, 1968 p 102–111
(AD-683121; FTD-HT-23-509-68) Avail: CFSTI CSCL 17/2.1

On the basis of a probability investigation of the distribution of critical frequencies of the F2 layer, conclusions are drawn concerning the advantages of predicting the probability of accomplishing radio communication by reflection of radio waves from the F2 layer on the maximal receiving frequency of F2.
Author (TAB)

N69-26906# Radio Corp. of America, Princeton, N.J. Communications Research Lab.
CADE/PANDA COMPUTER ASSISTED DATA EVALUATION PROGRAM FOR PANDA
J. O. Sinniger 17 Jan. 1969 113 p refs *Its* Spec. Topic 25
(Contract N00039-68-C-1518)
(AD-683722) Avail: CFSTI CSCL 17/2.1

This report, which discusses the software for the PANDA seasonal statistical analysis, also examines the hardware concept, the programming concept, the field site tape compatibility and transcription, and the statistical report generation. Examples are included to demonstrate program deck preparation. Author (TAB)

N69-26978# Joint Publications Research Service, Washington, D.C.
RADAR FUNDAMENTALS, AUTOMATIC SYSTEMS, AND RELIABILITY THEORY
A. M. Pedak et al 16 Apr. 1969 47 p Transl. into ENGLISH from the book "Spravochnik po Osnovam Radiolokatsionnoy Tekhniki" Moscow, Voyennoye Publishing House, 1967 p 29–39, 51–67, 170–174, 464–467, 583–585
(JPRS-47864) Avail: CFSTI

Selected passages from an introductory level textbook are presented. Specific topics covered include: (1) radar signal detection, including the partial pattern and single pulse methods; (2) methods of measuring the flight altitude of a target; (3) systems for selection of moving targets (SMT) including coherent pulse SMT, SMT balancers, blind target velocities, wind compensation devices, coherent-pulse SMT systems with external coherence, and two-frequency SMT; (4) provisional designations of electrovacuum and semiconductor electronic instruments; (5) automatic amplification regulation systems; and (6) safety when servicing radar equipment.
K.R.G.

N69-26986# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FOR CONTINUOUS CONTROL
N. Izyumov 19 Nov. 1968 8 p Transl. into ENGLISH from Voyennyy Vestn. (USSR), no. 2, 1968 p 42–44
(AD-684010 FTD-HT-23-931-68) Avail: CFSTI CSCL 17/2.1

The author reports on the practical application of a new type of communications involving the backscattering of ultrashortwaves in the troposphere and ionosphere, offering communications of up to several thousand km. With small radio stations it is possible to effect remote control of powerful radio stations. All communications equipment is protected from random and active jamming and will operate reliably while nuclear and other weapons are being used.
Author (TAB)

N69-27024# Joint Publications Research Service, Washington, D.C.
DIGITAL METHOD OF OPTIMAL PROCESSING OF RADAR SIGNALS
S. V. Samsonenko 13 Mar. 1969 287 p refs Transl. into ENGLISH of the book "Tsifrovyye Metody Optimal'noy Obrabotki Radiolokatsionnykh Signalov" Moscow, Military Publishing House of the USSR Min. of Defense, 1968
(JPRS-47627) Avail: CFSTI

The problems of using digital computers for optimal processing radar signals are investigated. Basic attention was given to detection of target signals hidden by noise and the determination of the target coordinates. The operation of the simplest processing systems, their working principles, and the operation of certain assemblies of digital computers are described. More complex cases, special theory and processing algorithms are then presented. It is demonstrated how the structures of the computers and their algorithms are synthesized on the basis of statistical solution theory. The required data on the theory of statistical solutions are given during the course of the discussion.
Author

N69-27029*# Litton Industries, San Carlos, Calif. Electron Tube Div.
ANALYTIC DESIGN OF A 2.0 GHz SPACE BORNE LINEAR INJECTED BEAM CROSSED FIELD AMPLIFIER Final Report
C. L. Jones and J. E. Orr 27 Oct. 1968 143 p refs
(Contract NAS3-11513)
(NASA-CR-72392) Avail: CFSTI CSCL 09C

The CFA is intended to serve as the output stage aboard a synchronous satellite. Experimental and analytic studies were performed with variations of the Karp interaction circuit. These results were used with small-signal and large-signal computer analyses to optimize interaction efficiency for the narrow bandwidth requirements of the intended application. Multi-element depressed collectors were analyzed using electron energy distributions from the large-signal interaction studies. Overall efficiencies in excess of 80% were computed for the output amplifier stage using a conventional crossed-field interaction region. Less conventional efficiency enhancement techniques were evaluated in order to obtain even higher device efficiency.
Author

N69-27031*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
THE TEMS APOLLO–SATURN 1B TRACKING SYSTEM ERROR MODEL RESULTS THROUGH THE AS-205 FLIGHT TEST
Bobby Junkin 13 Mar. 1969 44 p refs
(NASA-TM-X-53818) Avail: CFSTI CSCL 17I

The TEMS method for determining the tracker error models involves establishing the tracker errors and then determining functional expressions to describe the established errors. Guidelines used in obtaining truncated error models have resulted in generally acceptable models.
Author

N69-27035# Signals Research and Development Establishment, Christchurch (England).
THE BUMP TESTING OF MILITARY SIGNALS EQUIPMENT IN THE UNITED KINGDOM
W. Childs Sep. 1968 9 p Presented at the 39th Shock and Vibration Symp., Monterey, Calif., 22–24 Oct. 1968
(AD-683842; SRDE-68021) Avail: CFSTI CSCL 17/2

The paper explains the need for mechanical proofing tests on equipments, sub-assemblies and components and briefly describes the first bump test machine built to carry out such tests, and the machines shortcomings. The characteristics of the current British bump test and the reasons for its form are dealt with, leading to the design and manufacture of the 501b and 2501b machines currently used in the U.K. capable of applying the test. The design, operation and performance testing of these machines is dealt with in some detail. Author (TAB)

N69-27080 Texas Univ., Austin.
DIRECTIVITY AND SPEECH INTELLIGIBILITY CHARACTERISTICS OF A LOGARITHMICALLY-SPACED MICROPHONE ARRAY IN A TEMPERATURE- AND WIND-STRATIFIED ATMOSPHERE
Allan Burnham Schmitt (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-16133

The sound intensity at a given distance from a point source is derived from fundamental considerations in terms of frequency, height of source, height of receiver, ambient temperature, temperature gradient, wind gradient, wind direction, and humidity. An algorithm is presented whereby a directional N-element microphone line array may be designed having an approximately flat frequency response (500-2500 cps) for all angles of incidence. The gain, directivity, and frequency response for this type of array is compared with a "parabolic microphone." Noise inputs at each microphone are generated having the appropriate coherency relationships as determined by a field experiment. This noise is then added to a spoken word which has been modified to represent conversation at a given range under the atmospheric conditions specified above. The combined signal with noise is then processed by the microphone array and the output played back through a loudspeaker to determine speech intelligibility. Dissert. Abstr.

N69-27081# AEG-Telefunken, Ulm (West Germany).
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF OPTIMUM ENCODING AND DECODING METHODS WITH AUTOMATIC ERROR CORRECTION FOR TRANSMISSION OF DIGITAL DATA IN SPACE FLIGHT [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN OPTIMALER CODIERUNGS- UND DECODIERUNGSVERFAHREN MIT AUTOMATISCHER FEHLERKORREKTUR DIGITALER MESSWERTUEBERTRAGUNGEN FUER AUFGABEN DER RAUMFAHRT]
W. Nettemann, J. Walz, and F. Huertas Oct. 1968 155 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forsch.
(BMwF-FB-W-68-73) Avail: CFSTI

For evaluation of the optimum efficiency of binary codes used with a view to improving the transmission safety of digital data in symmetrical channels without any memory and subject to interference, the probability of block errors is computed as a function of the channel characteristics at the two limit values determined by Hamming and Varsharmow-Gilbert for block lengths of n<60 and of the number of data locations (k = 5, 7, 10, 14, 15 and 21). The computations permit a qualitative and a quantitative evaluation of binary codes and furnish information on the optimum composition of codes. Two basically different types of decoders for error-correcting codes are analyzed, and their method of operation as well as their design concept are described in detail. The complexity of the equipment is expressed in terms of electrical functional units; its advantages and disadvantages are then discussed. Author (ESRO)

N69-27127*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERFERENCE SUSCEPTIBILITY OF SATELLITE 136 MHz TELEMETRY LINK
Ralph E. Taylor and Ming S. Moy (Lockheed Electron. Co.) Nov. 1968 29 p refs Submitted for publication
(Contract NAS5-9243)
(NASA-TM-X-63541; X-523-68-470) Avail: CFSTI CSCL 17B

Radio frequency interference (RFI) susceptibility measurements were made on a satellite 136 MHz telemetry radio link utilizing a pulse coded, split phase type (PCM/PM) modulation. Both co-channel and adjacent-channel types of interference were simulated, representing RFI from other satellites and VHF voice amplitude modulated (AM) interference from aircraft, both being typical of that experienced by the NASA space tracking and data acquisition network (STADAN). Signal-to-interference receiving system thresholds were established, and a VHF receiver preselector-type filter system was developed to reduce RFI. Author

N69-27140# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF DETERMINATION OF AMPLITUDE AND PHASE OF A TIME-QUANTIZED PERIODIC SIGNAL
E. V. Sergeev 20 Feb. 1968 13 p refs Transl. into ENGLISH from Geofiz. Apparatura (USSR), no. 27, 1966 p 120–124
(AD-683281; FTD-MT-24-398-67) Avail: CFSTI CSCL 9/4

This paper discusses methods for the determination of amplitudes and phases of the harmonic components of a suitable data hold of a time quantized (sampled) signal. Expressions for the demodulator outputs in the case of the synchronous detection method, and in the case of the harmonic analysis method are given. The central topic is the choice of a sufficient, effective integration time interval, in terms of the number of the discreet sampling intervals, which would assure optimum precision. Expressions for the minimum attainable errors are developed for the synchronous detection method, and conditions for the attainment of perfect precision with the harmonic analysis method are specified. Comparison of these two methods shows the superiority of the harmonic analysis method, as far as precision is concerned. However, the method requires consideration of a double number of harmonic components and requires an additional operation of multiplication. The method of synchronous detection recommends itself only in those cases when the data hold function of the discrete signal is in its form close to a sinusoid. The proposed computational block diagram can be realized by either analogue or digital components. TAB

N69-27155*# Ohio State Univ., Columbus. ElectroScience Lab.
MILLIMETER-WAVELENGTHS PROPAGATION STUDIES Semiannual Status Report
15 Apr. 1969 17 p
(Grant NGR-36-008-080)
(NASA-CR-101228; SASR-2374-3) Avail: CFSTI CSCL 17B

Preparations for electroscience laboratory participation in the NASA ATS-E millimeter wave propagation experiment are described. Two receiving terminals, one fixed in location and one transportable, are under construction and will be essentially complete for the planned August, 1969 launch of the satellite. Author

N69-27180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING THE DIMENSIONS OF EFFECTIVE RADIATION ZONES OF CONICAL SPIRAL ANTENNAS
A. B. Goroshchenya 12 Jul. 1968 17 p refs Transl. into ENGLISH from Izd. Vysshikh Uchebn. Zavedenii Radioelektr. (USSR), v. 10, no. 2, 1967 p 150–156
(AD-683050; FTD-MT-24-159-68) Avail: CFSTI CSCL 9/5

An expression is derived for determining approximately: (1) Dimensions of the effective radiation zones of conical spiral antennas, and; (2) Propagation direction of waves radiated at each point of such a zone. This expression is shown to confirm some previously advanced hypotheses on the radiation mechanism of modern wide-band antennas. As an example, the equation is applied to an analysis of logarithmic and archimedean spiral antennas. Author (TAB)

N69-27199# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPACE TELEVISION (SELECTED CHAPTERS)

P. F. Bratslavets et al 9 Jul 1968 90 p Transl. into ENGLISH from the book "Kosmicheskoye Televideniye" USSR, Izd-Vo Svyaz, 1967 p 7–131

(AD-683166; FTD-MT-24-158-68) Avail: CFSTI CSCL 17/2

Contents: Television means for space investigations; The low-frame method of transmitting television information from outer space; Domestic television system for the investigation of space; Spacevision systems. TAB

N69-27211# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BULLETIN OF THE STATIONS FOR OPTICAL OBSERVATION OF ARTIFICIAL EARTH SATELLITES (SELECTED ARTICLES)

13 Sep 1968 31 p refs Transl. into ENGLISH from the book "Byulleten Stantsiy Opticheskogo Nablyudeniya Iskusstvennykh Sputnikov Zemli" (USSR) p 3–17

(AD-683155; FTD-HT-23-562-68) Avail: CFSTI CSCL 22/2

Contents: Brightness variability of carrier rockets; Period of rotation of the carrier rocket of the third Soviet satellite; Methods of photometry of artificial earth satellites. TAB

N69-27295# National Physical Lab., New Delhi (India). Radio Propagation Unit.

ELECTRON CONTENT MEASUREMENTS OVER DELHI FROM FARADAY FADING OF SATELLITE EXPLORER-22 (S-66) TRANSMISSIONS

Tuhi Ram Tyagi 15 Sep 1968 15 p *Its* Satellite Data Ser. No. 3

(RPU-S44; SR-44) Avail: CFSTI

Radio transmissions from the Explorer 22 satellite on 20, 40, and 41 MHz have been recorded ever since the satellite was launched. The electron content values are presented for the period January 1967 through December 1967 for each satellite pass at the time of closest approach. The time is given in nearest full minute in UT, along with satellite zenith angle at closest point of approach. The electron content tables also contain the corresponding f_0F_2 values, deduced from C4 ionograms recorded at Delhi, solar flux, and magnetic index $\sum K_p$ values for reference. Plots of diurnal variations of electron content and N_mF_2 during winter, summer, and equinox are also given. Author

N69-27313# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DETERMINATION, BY MEANS OF AN ANALOG ENERGETIC SIMULATION OF THE RADIATION AND THE PROPERTIES OF AN AXISYMMETRIC ANTENNA IN VACUUM OR IN A REACTIVE AND DISSIPATIVE MEDIUM (PLASMA) [DETERMINATION, AU MOYEN D'UNE SIMULATION ANALOGIQUE ENERGETIQUE, DU RAYONNEMENT ET DES PROPRIETES D'UNE ANTENNE DE REVOLUTION PLONGEE DANS LE VIDE OU DANS UN MILIEU REACTIF ET DISSIPATIF (PLASMA)]

Josef Fritz 1968 97 p refs In FRENCH; ENGLISH summary

(ONERA-NT-130) Avail: CFSTI

Determination and design of an analog computer able to simulate antenna radiation in a vacuum and in a plasma of given characteristics, such as that surrounding a body reentering the atmosphere, are presented. This computer was conceived within the framework of the analog energetic theory developed by P. Alais. The results obtained on the machine give, after reduction, all the various characteristic data of an antenna, such as the radiation impedance and the radiation diagrams. It is also possible to visualize the equi-field charts giving the near fields immediately around the exciting element. This new machine opens new vistas for the design of axisymmetrical antenna; it shows that the concept of an unfamiliar large network can very well be considered on the technological point of view. Author

N69-27361# Joint Publications Research Service, Washington, D.C.

APPRAISAL OF METHOD FOR TRANSMITTING VIDEO SIGNAL FROM COASTAL RADARS

V. A. Vasilenko 16 May 1969 10 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn. Issled. Inst. Morsk. Flota (Leningrad) no. 91, 1968 p 49-56

(JPRS-48050) Avail: CFSTI

A comparison of wide-band and narrow-band methods of transmitting complex radar signals is made considering the reproduction of the high quality radar image at the receiver location. The effect of interferences in the communication channel is represented by the difference between the brightness of the original image elements and the brightness of the corresponding elements of the image reproduced, after going through the communication channel, on the indicator screen. Different natures of interference, occurring in the dispatcher indicator with different transmission methods, require the comparison of the signal to noise ratio magnitudes, with the aim of selecting the one with which the image is perceived subjectively as free from noise. These factors are investigated for both the direct (wide-band) and discrete (narrow-band) methods of radar video transmission. Information effectiveness and the economic soundness of commonly used transmission methods are also considered. P.A.B.

N69-27400# Forsvarets Forskningsanstalt, Stockholm (Sweden).

METHODS FOR GENERATING A SINGLE AND DOUBLE SIDEBAND WITH SUPPRESSED CARRIER WAVE AT X BAND AT MODULATION FREQUENCIES OF 30 MHz AND 10-100 kHz WITH MIXERS AS MODULATORS [METODER FOR GENERERING AV ENKELT OCH DUBBELT SIDBAND MED UNDERTRYCKT BARVAG I X-BANDET VID MODULATIONSFREKVENSERNA 30 MHZ OCH 10-100 KHZ MED BLANDARE SOM MODULATORER]

Lennart Beijbom Jul 1967 32 p refs In SWEDISH; ENGLISH Summary

(FOA-3-A-3694-62) Avail: CFSTI

Single and double sideband (SSB and DSB) generation with suppressed carrier wave for microwave frequencies has an application in Doppler radar. Starting with basic circuits consisting of a 3 dB coupler with mixers as modulators, theories for generating SSB and DSB are discussed, assuming a sine wave amplitude modulation. The modulation is treated as a switching procedure. It is shown that one of the SSB circuits is equivalent to a balanced mixer with suppressed mirror frequency. Application is demonstrated with simple experiments carried out with ordinary laboratory equipment. Two simple circuits are described for generating SSB with suppressed carrier wave for carrier wave frequency 9500 MHz; one has a modulation frequency of 30 MHz, the other a modulation frequency from 10 to 100 kHz. For the 30 MHz, an output power of 2 mW SSB was obtained when the input carrier wave power was 20 mW, and with 10 to 100 kHz the output was 0.2 mW SSB with carrier wave power of 16 mW. The suppression of the

carrier wave and the undesired sideband relative to the desired sideband was ≥40 dB for 30 MHz and 15 to 20 dB at 10 to 100 kHz. The circuits are narrow-band and most suitable for single frequency applications. K.W.

N69-27480*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONOPULSE SYSTEM WITH AN ELECTRONIC SCANNER
Armondo D. Elia and Richard F. Schmidt, inventors (to NASA) Issued 8 Apr. 1969 (Filed 13 Jun. 1967) 8 p Cl. 343–854 (NASA-Case-XGS-5582; US-Patent-3,438,044; US-Patent-Appl-SN-646424) Avail: US Patent Office CSCL 17I

An electronic sum-and-difference pattern scanning network is described for use in the control system of a monopulse tracking antenna. The control system provides a means for both mechanically and electronically scanning a target, with the mechanical means providing a rough determination of the location of a target and the electronic means providing an exact determination of the location of the target. The electronic pattern scanning network utilizes a plurality of square and ring hybrids and a plurality of phase shifters to scan the sum-and-difference patterns of a monopulse tracking system in a predetermined manner to provide a vernier control system for the tracking antenna.
Official Gazette of the U.S. Patent Office

N69-27462*# Westinghouse Electric Corp., Baltimore, Md.
BROADBAND CHOKE FOR ANTENNA STRUCTURE
Otis L. Bishop and Conway A. Bolt, Jr., inventors (to NASA) Issued 18 Feb. 1969 (Filed 15 Feb. 1967) 5 p Cl. 333–97 (NASA-Case-XMS-5303; US-Patent-3,428,923; US-Patent-Appl-SN-617022) Avail: US Patent Office CSCL 09F

A support structure containing a coaxial line feed system is used to connect a pair of arrays for radiating circularly polarized waves which produces a doughnut shaped field pattern. Mounted on the support structure are a pair of quarter wavelength shaped chokes whose shortened ends are connected by an absorbing material. At the center frequency of interest, the quarter wavelength chokes present open circuits to the currents induced on the support structure. At frequencies off center, those currents which are not suppressed by the choke are absorbed by the absorbing material. Thus, the resulting field pattern is not affected by currents induced in the support structure. Official Gazette of the U.S. Patent Office

N69-27556# National Aerospace Lab., Tokyo (Japan).
ON THE ORBIT DETERMINATION PROCEDURES FOR THE DOPPLER FREQUENCY MEASUREMENT WITH THE ANGULAR MEASUREMENT TRACKING SYSTEM
Ryozo Toriumi, Kazuo Matsumoto, Kazuo Higuchi, Hayato Togawa, and Takeo Kimura 1968 49 p refs In JAPANESE; ENGLISH summary
(NAL-TR-168) Avail: CFSTI

Doppler frequency measurement with the angular measurement method was chosen as the tracking system for a scientific satellite launch plan. Actual satellites were tracked by experimental devices. Procedures for orbital determination were proved mathematically and experimentally. Author

N69-27578# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 91, NO. 1: THE INFLUENCE OF SYSTEMATIC OBSERVER ERROR ON THE DETERMINATION OF RADIO-METEOROLOGICAL VALUES (ESPECIALLY N GRADIENT) [METEOROLOGISCHE ABHANDLUNGEN. BAND XCI, HEFT 1: DER EINFLUSS SYSTEMATISCHER BEOBACHTUNGSFEHLER AUF DIE BESTIMMUNG RADIOMETEOROLOGISCHER GROESSEN (SPEZIELL N-GRADIENT)]
Ulrich Schaffert 1968 80 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

The theory of sensor time lag and some resultant possibilities for lag-correcting the radiosonde data are discussed. An introduction into the fundamentals of the propagation of horizontal pointing radar rays relative to the earth depending upon the vertical N-gradient is given, and an attempt to determine the N-gradient indirectly using a radar antenna rotating in the horizontal plane is described. Measured and lag-corrected values of the vertical gradient of refractivity are compared with indirectly determined N-gradients. Author

N69-27598# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
THE MEASUREMENT OF THE FLEXURAL WAVE PROPAGATION VELOCITY BY CORRELATION TECHNIQUES
Nobuharu Aoshima and Juichi Igarashi Mar. 1969 18 p refs Reprinted *Its* Vol. 34, No. 3
(ISAS-436) Avail: CFSTI

The group delay time is defined for the dispersive wave propagation system. It is the time which is required for the envelope of the narrow band input signal to travel through the system. Three methods of detecting the group delay time by correlation techniques were developed, and the experiments were performed in a flexural wave propagation system. Author

N69-27599# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
APPLICATION OF QUASI-OPTICAL SCATTERING THEORY TO A PARABOLOID ANTENNA Final Report
John O. Clark Apr. 1969 114 p refs
(CAL-UA-2707-E-1) Avail: Issuing Activity

An investigation of a paraboloid antenna was performed to determine useful analytical expressions for the far-field antenna pattern. The primary excitation was a half-wave electric dipole located at the paraboloid focus. Computations and experimental measurements were compared to demonstrate the particular regions in which the analytical expressions are valid. Methods of modifying the selected theories in specific regions are presented. Emphasis is placed on the solution of the principal-plane and cross-polarized components of the radiated field. The solution for the antenna pattern in other planes is considered straightforward. It was found that physical optics and geometrical diffraction theorty (GDT), coupled with solutions from related problems, could be extended to satisfactorily agree with experimental results. These techniques were applied in the main lobe and, with some reservations, in the backlobe sectors. In the remaining region, GDT alone was sufficient except near the direct-shadow boundary. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-26153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE METHOD OF REALIZING AUTOMATA IN A COMPUTER MEDIUM
B. A. Sidristyi 18 Nov. 1968 13 p refs Transl. into ENGLISH from Tr. Simp. po Vichislitelnym Sistemam (Novosibirsk), 1967 p 209–214
(AD-683955; FTD-HT-23-805-68) Avail: CFSTI CSCL 9/2

A realization of an automaton in a computing medium is considered, in which the time-logic-function language is used as an input language. TAB

N69-26163# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CRYOTRON AS A LOGIC ELEMENT
I. A. Artemenko 6 Nov. 1968 15 p ref Transl. into ENGLISH from Dokl. Seminar Fiz.-Tekhnol. Vop. Kibern. (Ukr.SSR), no. 1, 1966 p 3–13
(AD-683994; FTD-MT-24-404-68) Avail: CFSTI CSCL 9/2

Potentialities are considered of a functionally complete system of logic elements based on the cryotron with a single control grid. Cryotron circuits are shown for all 16 switching functions of two binary variables. The following conclusions are reported as a result of an analysis: (1) Cryotrons permit using a wide functionally complete system of five elements (negation, disjunction, conjunction NOR, and Webb function) which requires 2–3 cryotrons for each element; the system has wider possibilities and flexibility than limited-basis schemes; (2) The mathematical apparatus developed for other systems of elements is also suitable for synthesizing cryotron logic circuits; (3) Greater number of arguments in logic functions requires minimal additional equipment in cryotron circuits; (4) Cryotron logic elements be equally well used as combination elements or as memory elements. TAB

N69-26193*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREPROCESSING OF MINITRACK DATA
Edward R. Watkins, Jr. Washington May 1969 24 p refs
(NASA-TN-D-5042) Avail: CFSTI CSCL 09B

The principles embodied in the Minitrack system are summarized for classification of the reduction process. The use of computers for tracking-data processing necessitates the transition of principles into algorithms; where applicable, the development of algorithms is included. The current procedures for preparing Minitrack data messages, and the current computer processing procedures, are presented with emphasis on a description of the IBM 360 computer program designed and developed on the basis of past experience with Minitrack data reduction. Author

N69-26199# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE APPROACH TO THE CLASSIFICATION OF COMPUTERSOLVED PROBLEMS
I. V. Sergienko 4 Oct. 1968 26 p refs Transl. into ENGLISH from Kibernetika (Ukrainian SSR), no. 4, 1967 p 31–38
(AD-683984; FTD-MT-24-336-68) Avail: CFSTI CSCL 9/2

The classification of electronic computers and of computersolved problems is a major factor in the optimization of the facilities of computer centers and the determination of the design features of newly planned computers and accessories. The design and planning of computers and computer systems are increasingly dominated by the tendency to match the structure of computational devices to the algorithms employed. The author discusses classification as according to: (a) feasibility of solution of the problems (the operational principle); (b) the volume of information utilized in the solution of the problem; (c) the required speed of solution of the problems and the required accuracy of that solution. TAB

N69-26206# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A GENERAL-PURPOSE, ANALOG–DIGITAL, IMMEDIATE-ACCESS DATA PROCESSING SYSTEM FOR INVESTIGATING OBJECTS WITH GENERAL-PURPOSE DIGITAL COMPUTER
Yu. M. Bykov et al 25 Sep. 1968 18 p refs Transl. into ENGLISH from Pribory i Sistemy Upr. (USSR), no. 7, 1967 p 28–32
(AD-683099; FTD-HT-23-704-68) Avail: CFSTI CSCL 9/2

A general-purpose, transistorized analog-digital system for acquisition and conversion of data is described. Intended for probabilistic studies of chemical, physics of heat, and other processes, the system can accommodate either direct inputs from sensors monitoring the above processes or an indirect input from graphs realizable either automatically or semi-automatically. System output is also either direct (coupled to machine actuating mechanisms) or indirect, where information is entered on perforated tapes or punched cards. Basic system blocks are the voltage-time interval-number A/D converter providing a parallel code output and a parallel-to-serial-parallel code converter. Code conversion is required for 5-channel perforated tape, which is used as input to digital computers. In addition to coded signals from the monitored processes, the tape carries auxiliary codes which are necessary to meet the input requirements of Minsk-1 and Minsk-2 computers. In direct computer entry mode, the codes are treated differently to make them compatible with photoelectric computer input readers. TAB

N69-26211# MITRE Corp., Bedford, Mass.
ALTERNATIVES IN EVALUATION OF COMPUTER SYSTEMS
Dennis W. Fife Dec. 1968 19 p refs
(Contract AF 19(628)-5165)
(AD-683693; MTR-413; ESD-TR-67-380) Avail: CFSTI CSCL 9/2

This essay is a commentary on the formal conduct of computer evaluation studies. Two contrasting viewpoints are discussed - that of a computer specialist and that of a non-specialist concerned with system acquisition. The opinion expressed is that any evaluation task normally has unique aspects which demand the attention and creative efforts of a computer specialist. For the specialist, a prescribed evaluation form and an associated scoring procedure, as frequently used in acquisition activities, do not constitute a satisfactory methodology for a technical evaluation. They are useful for planning, or as a means of documentation if suitably modified and extended during the evaluation effort. Author (TAB)

N69-26214# System Development Corp., Santa Monica, Calif.
ADVANCED DEVELOPMENT PROTOTYPE, PART 1 Final Report, 20 Jul. 1968–30 Jan. 1969
J. I. Schwartz 30 Jan. 1969 60 p refs
(Contract DAHC15-67-C-0149; ARPA Order 939)
(AD-683670; SDC-TM-3628/003/00-Pt-1) Avail: CFSTI CSCL 9/2

The report describes ADEPT--a comprehensive information-processing system implemented at SDC for operation on IBM 360 computers. The report includes an overview of the current status of the system, and a detailed description of the three major components of ADEPT; a time-sharing executive, a data management component (consisting mainly of the Time-Shared Data Management System), and a programmers package, which includes a JOVIAL compiler, editing debugging, and utility programs, a teletype interpreter (TINT), and an Interactive Programming Support System. Also included in this document are the names of staff members assigned to each of the three major project areas, as well as a listing of the documents produced in each area during this reporting period. Upon request, referenced documents will be made available to appropriate organizations. Author (TAB)

N69-26222# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FERROMAGNETIC THIN-FILM MEMORY UNIT
A. D. Bekh, V. M. Korsunskii, G. A. Mikhailov, and M. A. Tersenov 6 Nov. 1968 12 p Transl. into ENGLISH from Mekhanic i Avtomatiz. Upr. (USSR), no. 4, 1967 p 34–37
(AD-683993; FTD-MT-24-401-68) Avail: CFSTI CSCL 9/2

The document describes a ferromagnetic thin-film memory unit which was designed so that any of its 128 16-bit words may be directly selected at a rate of 1.1 MHz, and which has been completed at the Institute of Cybernetics, Academy of Sciences Ukr SSR. TAB

N69-26230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASE IN THE TOLERANCES OF THE WORKING CURRENTS OF MAGNETIC FILM ELEMENTS OF MEMORY DEVICES WITH DIRECT ACCESS
G. P. Zharikov 23 Aug. 1968 11 p refs Transl. into ENGLISH from Fiz.-Tekhnologicheskie Vopr. Kibernetiki (USSR), no. 1, 1966 p 57–63
(AD-683122; FTD-HT-23-284-68) Avail: CFSTI CSCL 9/2

A difficult problem in developing storage devices based on magnetic films is the technology of manufacture of films possessing prescribed properties. The present article presents the results of studying the technological feasibility of raising the effective characteristics of film elements. TAB

N69-26285 Maryland Univ., College Park.
DYNAMIC MEMORY ALLOCATION
Paul Eugene Peters (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-16682

A technique of dynamic memory allocation for use in multiprogrammed data processing systems is described. Analysis of the allocation costs shows that in certain practical systems the technique offers several advantages over the use of a paging system. The algorithm allocates variable length blocks corresponding to logical segments and makes use of two lists, one for allocation and the other for collection of blocks. The junk concept, which does not permit making allocations from small unused blocks, is introduced as a technique for reducing allocation overhead. The major allocation costs of the allocation algorithm are wasted memory due to fragmentation and overhead in searching lists for allocation and release. Analysis, including the use of digital simulation of the algorithm, is used to show that when allocating small segments in a large memory the fragmentation loss is less than the wasted memory in a paging system. The M/M/R queueing model is seen to provide a model for predicting the probability of having requests for which memory cannot be allocated in a system using the allocation algorithm without memory swapping. The shorter execution times obtained with minimal hardware support makes this allocation technique advantageous for use in systems which emphasize production type service. Dissert. Abstr.

N69-26291 California Univ., Los Angeles.
INVESTIGATION OF THE FIELD OF PROBLEMS FOR THE BOOLEAN ANALYZER
Miguel Angel Marin (Ph.D. Thesis) 1968 187 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-16560

Design automation is treated as a problem where a large set of statements with known or unknown validity is presented. Problems in general are transformed to obtain a general set of Boolean equations. The number of Boolean variables in such equations is usually very large. Recently, a new processor, called Boolean Analyzer (BA), has been proposed. This unit operates as part of an automatic computer and is based on the idea of processing many terms of Boolean algebra in parallel. One of its operational capabilities is the solution of large systems of Boolean equations within a reasonable time. To promote the use of the BA in its two modes of operation, some applications to logic problems are developed. It is shown how the BA should be integrated with a general purpose computer to solve: (1) the Three-level AND-NOT synthesis problem of logic networks using only True inputs (synthesis of TANT networks); and (2) the general synthesis of logic networks using a restricted inventory of integrated circuit modules. The task includes reformulation of these problems into Boolean equations to prove their solubility by a BA integrated with another system. Dissert. Abstr.

N69-26302# MITRE Corp., Bedford, Mass.
THE FIRST ACM WORKSHOP ON MICROPROGRAMMING
Joseph E. Sullivan Feb. 1969 43 p ref
(Contract F19628-68-C-0365)
(AD-683714; MTR-805; ESD-TR-68-445) Avail: CFSTI CSCL 9/2

The Workshop on Microprogramming, sponsored by the ACM with the cooperation of MITRE, took place on October 7-8, 1968. This paper is primarily an historical account and summary of the workshops business, with some commentary. Author (TAB)

N69-26351# Joint Publications Research Service, Washington, D.C.
FUNCTIONAL EQUIVALENCE OF FINITE-STATE AUTOMATA
A. A. Letichevskiy *In its* Cybernetics and Regulation Theory 19 May 1969 p 14–17 refs (See N69-26348 14-05)
Avail: CFSTI

Functional equivalence of the controlling automata is defined. This concept is introduced beginning with the syntactical structure of the language in which the operators realized by the output signals of the controlling automaton; the conditions determining its transitions are given. The problem of functional equivalence turns out to be algorithmically irresolvable. Author

N69-26396 California Univ., Los Angeles.
MEMORY ALLOCATION IN COMPUTER SYSTEMS
Daniel Pierre Bovet (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-16601

The problem of memory allocation for multiprocessed computational tasks is investigated. A first memory allocation algorithm was proposed which operates under the assumption that a computational task was scheduled on p processors of a multiprocessor computer system prior to its execution on the computer. The a priori memory allocation algorithm uses a model of the computational task for which memory space must be allocated. This model consists of an acyclic directed bilogic graph. The characterization of the graph requires a priori estimates of the expected number of times each cycle will be traversed, the mean execution time of each computation, and the names and corresponding dimensions of all the space-taking entities associated with each computation. Dissert. Abstr.

N69-26397 State Univ. of New York at Buffalo.
OPTIMUM DESIGN OF DISCRETA DATA CONTROL SYSTEMS HAVING PRESPECIFIED DYNAMICS
Norman Joseph Bergman (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-17307

This dissertation develops a theory for the synthesis of linear discrete multivariable systems whereby the discrete plant dynamics and weighting parameters of a minimized quadratic performance index are related via the root square locus. This permits the dynamics of a plant to be specified a priori, while embedding the design problem into an optimal control problem. The required design is effected by the numerical solution of simultaneous linear algebraic equations for either stable or unstable open loop plants.

Some important aspects of the discrete calculus of variations are developed and are combined with discrete optimal control theory to supply necessary and sufficient conditions for an absolute minimum of the quadratic cost function. Dissert. Abstr.

N69-26402# Iowa Univ., Iowa City. Dept. of Mathematics.
ON THE COMPLEXITY OF GRAMMARS
Arthur C. Fleck Feb. 1969 23 p refs
(Contract N00014-68-A-0500)
(AD-683296; UI-TR-4) Avail: CFSTI CSCL 5/7

Grammars are categorized according to the type of the set of all derivations of elements of the language of the grammar. In particular, it is shown that a grammar has a regular set of derivations (is simple if and only if the grammar is nonterminal bounded). Also it is shown that a language is simple if and only if it is meta-linear. Finally, it is shown that for a context-free grammar the set of derivations is always context-sensitive but may not be context-free. Author (TAB)

N69-26412# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut für Flugmechanik.
REPORT ON THE COMPUTER CENTER OF THE DEUTSCHE FORSCHUNGSANSTALT FUER LUFT- UND RAUMFAHRT, 1 JANUARY 1967–31 AUGUST 1968 [BERICHT UEBER DAS RECHENZENTRUM DER DEUTSCHEN FORSCHUNGSANSTALT FUER LUFT- UND RAUMFAHRT FUER DIE ZEIT VOM 1. JANUAR 1967 BIS 31. AUGUST 1968]
Rudolph Ludwig Dec. 1968 56 p In GERMAN; ENGLISH summary
(DLR-Mitt-68-05) Avail: CFSTI

Following an earlier report on the DFL-Computer Center for 1966 a further report is represented covering the period from 1 January 1967 to 31 August 1968. The equipment configuration was not changed during this time, however, the number of programs run has greatly increased. From 1 September 1968 the Siemens 2002 computer will be replaced by the more powerful Siemens 4004/45 computer. Author (ESRO)

N69-26426# National Physical Lab., Teddington (England). Central Computer Unit.
SOME CHARACTER DESIGNS FOR THE RUSSIAN ALPHABET FOR USE WITH A GRAPHICAL OUTPUT DEVICE
B. R. Heap and Monica G. Pink Feb. 1969 12 p refs
(NPL-CCU-4) Copyright. Avail: CFSTI

The use of the NPL graphical output system for drawing letters of the Russian alphabet, both in upper and lower case, is described. ESRO

N69-26427# National Physical Lab., Teddington (England). Central Computer Unit.
A SIMPLE PROGRAM FOR DRAWING FLOW CHARTS
Joyce Dickerson and B. R. Heap Feb. 1969 19 p refs
(NPL-CCU-5) Copyright. Avail: CFSTI

A program that has been written by the National Physical Laboratory to enable users to draw flow charts on an incremental plotter is described. ESRO

N69-26515# Radio Corp. of America, Princeton, N.J. RCA Labs.
A TRANSLATION DESCRIPTION SYSTEM FOR COMPUTER LANGUAGES
Marvin C. Paull Dec. 1968 56 p refs
(Contract F44620-68-C-0012)
(AD-683784; SR-6) Avail: CFSTI CSCL 9/2

The outline of a system for describing significant programming language translations is given. An attempt is made to justify the inclusion of certain features of the system. This is done by giving examples of their usefulness -- as well as some proofs that without some such features certain classes of translations would be impossible. Author (TAB)

N69-26601# National Oceanographic Data Center, Washington, D.C.
USER'S GUIDE FOR NODC'S DATA PROCESSING SYSTEMS
Sonja Schuyler, comp. 1969 159 p refs
(G-15) Avail: Issuing Activity

The purpose of this guide is to help those receiving data and data products from the National Oceanographic Data Center (NODC) to make better use of the material obtained. In addition, it should help data requesters to intelligently formulate inquiries based on a knowledge of the capabilities (and limitations!) of the data base. In the evolution of NODC, modifications have occurred in the physical characteristics of the data base and in the methods of data storage, retrieval, and display. Many of these changes came about as a direct result of users' requirements; for example, general retrieval programs were modified to reflect these requirements to the fullest extent possible. Of course, special programs still have to be designed to meet specific problems. However, as our knowledge of requirements grows, our systems and services will expand. Author

N69-26630# Maryland Univ., College Park. Computer Science Center.
WEB GRAMMARS
John L. Pfaltz and Azriel Rosenfeld Jan. 1969 42 p refs
(Contract Nonr-5144(00))
(AD-683684; TR-69-84) Avail: CFSTI CSCL 5/7

Classes of phrase-structure grammars are defined whose languages consist, not of strings of symbols, but of directed graphs with symbols at their vertices (webs). Examples of such web grammars are given, having languages consisting of trees, of two-terminal series-parallel networks, and of triangular networks. It is shown that if the graphs permitted in a context-sensitive web grammar are required to be acyclic, and the parsing rules are assumed to be graph homomorphisms, then any subgraph which is parsed by a rule must be convex, and any rule is a composite of rules each of which parses a subgraph having just two points. Author (TAB)

N69-26657# Illinois Univ., Urbana. Dept. of Computer Science.
MATRIX INVERSION AND ITERATIVE REFINEMENT
Donald S. Edgar 27 Jun. 1968 30 p refs
(PB-180037; ILLIAC-4-194) Avail: CFSTI CSCL 09B

The method used here is more efficient for use on ILLIAC 4 than Gaussian LU decomposition because of more full use of processing elements. The assembly language code included here is written for the current version of the ILLIAC 4 assembler currently running on the B5500. Flow chart and discussion of specific problems encountered in the writing of assembly language are also included. Author (USGRDR)

N69-26701 Southern Methodist Univ., Dallas, Tex.
PROBABILITY MODELS AND COMPUTER SYSTEM DESIGN
Jack Evvard Shemer (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-17052

The research presented in this dissertation investigates the performance and design of digital computers by means of mathematical models. The computer system and integral components of the system are mathematically described by isolating and reducing the number of salient variables. Utilizing this macroscopic view of the system, probability expressions are formed and the system is analyzed under stationary assumptions. Study is focused

upon particular approaches to three general computer system design problems—(1) program scheduling within time-shared systems, (2) storage allocation in multiprogrammed systems, and (3) hardware organization for processor look-ahead in systems with multiple main memories. The round-robin scheduling discipline is analyzed for a variety of assumptions ranging from constant quantum allocation to adaptive (variable) quantum allocation with overhead and from unlimited queue size to finite queue capacity. Dissert. Abstr.

N69-26705# Illinois Univ., Urbana. Coordinated Science Lab.
ISL—A STRING MANIPULATING LANGUAGE
E. C. Kelley, S. R. Ray, and F. A. Stahl Feb. 1969 30 p refs
(Contract DAAB07-67-C-0199)
(AD-683498; R-407) Avail: CFSTI CSCL 5/2

The Information Search Language (ISL) is described. ISL is a problem-oriented language designed to facilitate the manipulation of real character strings. Author (TAB)

N69-26820# Picatinny Arsenal, Dover, N.J. Data Processing Systems Office.
CUVFIT: A CURVE-FITTING PROGRAM WITH PLOTTING OPTIONS
Robert E. Barnas and Carl R. Rosequist Dec. 1968 106 p refs
(AD-683471; PA-TM-1854) Avail: CFSTI CSCL 12/1

CUVFIT is a curve fitting program, for the IBM 360/65, that fits data points to nine emperical equations by method of least squares. There are available plotter options for the Cal Comp plotter. TAB

N69-26821# Picatinny Arsenal, Dover, N.J. Data Processing Systems Office.
EDITOR—A COMPUTER PROGRAM FOR DOCUMENTATION PURPOSES
William H. Bolte Dec. 1968 30 p
(AD-683474; PA-TM-1871) Avail: CFSTI CSCL 5/2

The report describes the application of an editing program called EDITOR for documentation purposes. This program was written in FORTRAN IV Language for the IBM 360/65 digital computer and requires a total memory length of 20,582 bytes. The EDITOR program permits the user to have his reports typed on an IBM 1403 highspeed printer. All text editing instructions (line spacing, underlining, centering, page numbering, etc...) are passed to the EDITOR Program by means of Alpha Numerical codes punched in Column 1 of the input data cards. The data cards contain the text of the report, having been punched from FORTRAN coding sheets upon which the author has written his report. Author (TAB)

N69-26823*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
MODIFICATION OF THE DIGITAL COMPUTER PROGRAM DPLANET TO INCLUDE THE EFFECTS OF DIFFERENTIAL-INPUT VOLTAGE-CONTROLLED VOLTAGE SOURCES
M. L. Gentry and L. P. Huelsman Mar. 1969 14 p refs
(Grant NGL-03-002-136)
(NASA-CR-101175) Avail: CFSTI CSCL 09B

A description is presented of the modified DPLANET, a digital computer program for the analysis of distributed-lumped-active-networks. The modification extends DPLANET's capability to include active elements which are differential-input voltage-controlled voltage sources of finite gain. Author

N69-26957*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE APPLICATIONS OF A MINIMIZATION ALGORITHM
J. P. Roth (Intern. Business Machines Corp.) and M. Penman 15 Apr. 1969 25 p refs
(Contract NAS7-100)
(NASA-CR-101229; JPL-TR-32-1385) Copyright. Avail: CFSTI CSCL 09B

The applications of an IBM 7094 minimization program to several design problems at the Jet Propulsion Laboratory are detailed. Specifically these applications are concerned with the design of a curve function generator for a mass spectrometer for a proposed Mars probe, and the design of autonomous shift registers with linear and nonlinear feedback, used for the classification of binary sequences and counting tasks for spacecraft scientific data processing. A description of the algorithm and the program used is followed by a description of the applications. Author

N69-26981# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.
FILE DESIGN FOR AN ON-LINE SYSTEM
J. G. Moxham (Digital Methods, Ltd.) Apr. 1969 16 p
(DSIS-TN-2; SAR-26) Avail: Issuing Activity

The present status of the file design effort for an on-line storage and retrieval system is reviewed. Only the bibliographic file and associated dictionary layouts are described. Updating and usage of these files are also discussed. Author

N69-26999# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STANDARDIZATION OF COMPUTER TECHNOLOGY FACILITIES
B. R. Kiselev 26 Nov. 1968 14 p refs Transl. into ENGLISH from Standarty i Kachestvo (USSR), v. 31, no. 10, 1967 p 28–31
(AD-684013; FTD-HT-23-506-68) Avail: CFSTI CSCL 9/2

In the past each computer manufacturing organization has had its own system of specifications, and the result has been a great variation in parameters of such computer equipment as analog and digital processors, magnetic tape, drum, and core memories, I/O units; and peripheral equipment such as tabulators, punchcard verifiers, sorters, and collaters. The author, as chief specialist on the standards committee, lists various reasons for the desirability of standardizing basic characteristics to make computer equipment compatible and interchangeable and presents a program for realizing this goal in the next two years. He expects that this action will also promote the establishment of procedures, technical requirements, and methods for testing computers that will result in their increased speed, capacity, and reliability, as well as in compatibility of instruction repertoires and software, development of modern I/O units, and centralization and specialization of manufacturing facilities for computers and their components. TAB

N69-27006# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUESTIONS REGARDING THE SYNTHESIS OF THREE-SIGN LOGICAL FUNCTIONS ON THRESHOLD ELEMENTS
I. N. Bogolyubov 9 Feb. 1968 15 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Riga), no. 11, 1965 p 5–17
(AD-683223; FTD-HT-23-1145-67) Avail: CFSTI CSCL 9/2

A study is made of methods of constructing schemes realizing three-sign logical functions assuming the values (-1, 0, 1). For elements of the scheme, we use three-digit threshold elements. Methods are proposed for synthesizing with respect to a basis - with respect to implicants of disjunctive normal form - and for synthesizing with elimination of variables. Examples are given. Author (TAB)

N69-27009# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MODELING A SPECIAL-PURPOSE DIGITAL COMPUTER FOR SMALL COMPUTATION JOBS ON A GENERAL PURPOSE-DIGITAL COMPUTER

G. I. Belik et al 9 Feb. 1968 7 p Transl. into ENGLISH from Avtomat. Vychisl. Tekh., Prib. Sist. Avtomat. (Kharkov), no. 3, 1966 p 165–167

(AD-683286; FTD-HT-23-37-68) Avail: CFSTI CSCL 9/2

A system is described by which a special-purpose digital computer, such as may be used for simple calculations and engineering computations, is modeled on the Minsk-14 computer. The system includes 15 consoles acting as I/O units. The AU, CU, and main memory of the modeled computer utilize the Minsk-14 components through special programs. Author (TAB)

N69-27075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME POSSIBILITIES OF USING STRUCTURAL REDUNDANCY IMPROVING THE RELIABILITY OF ANALOG–DIGITAL FUNCTION CONVERTERS

V. P. Chapenko 8 Nov. 1968 22 p refs Transl. into ENGLISH from Avtomat. Upr. (Riga), 1967 p 229–244

(AD-683996; FTD-MT-24-409-68) Avail: CFSTI CSCL 9/2

The review of the methods of enhancing the reliability of computer input devices covers the following points: (1) Designing error-correcting analog-digital converters (ADC); types of errors. (2) Enhancing the reliability of analog devices by correcting errors. (3) Enhancing reliability of pulse counters and distributors of ADCs. (4) Potentialities of function generation by ADC. TAB

N69-27093*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPECIFICATIONS FOR ASAP AND SATURN SIMULATION SYSTEM

J. W. Hilliard 29 Nov. 1968 54 p refs

(NASA-TM-X-53800) Avail: CFSTI CSCL 09B

Presented in this report are the functional specifications for two computer programs as follows: (1) A computer program, ASAP and Saturn Simulation, that will simulate Automatic Storage And Playback (ASAP) and Saturn telemetry formats. Tables and figures are included to help define eight provisions required of this program. (2) A computer program, Predicted Data Tape, that will convert the instrumentation program and components list card data to paper tape. This tape will contain the input data for the ASAP and Saturn Simulation Program. Tables, figures, and an appendix are included to help define input, output, and three provisions required of this program. Purposes and procedures are also explained. Author

N69-27134# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

READING AUTOMATON WITH OPTICAL STANDARDS AND AN ELECTRON-OPTICAL CONVERTER

G. L. Gimelfarb et al 24 Oct. 1968 14 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), no. 3, 1968 p 180–183

(AD-683544; FTD-HT-23-953-68) Avail: CFSTI CSCL 9/2

Described herein is a prototype of a reading automaton, intended for testing the possibility and feasibility of using electron-optical converters in recognition mechanisms with optical standards. The recognition method employed in the prototype has increased stability to changing contrast and to printing defects of the image being recognized. The prototype permits recognition of 10 typewritten symbols (figures), printed on an ordinary sheet of paper, with a speed on the order of 10 symbols per s. Author (TAB)

N69-27153# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

A SOLUTION PROCEDURE FOR A CLASS OF MULTISTAGE LINEAR PROGRAMMING PROBLEMS UNDER UNCERTAINTY

R. Jagannathan 1 Nov. 1968 36 p refs

(Contract Nonr-760(24))

(AD-683321; WP-29-68-9; RR-146) Avail: CFSTI CSCL 12/2

In stochastic linear programming it is necessary to distinguish two major classes of problems. First, the static models for which only one decision has to be made and second the dynamic models which involve sequential decision-making. Since more and more information will be available in succeeding periods, a dynamic model entails an adaptive policy prescription which involves a choice of decision vector for the ith period under all possible alternative realizations of the random variables observed before the ith period. A general multi-stage LP(U superscript 2) model is defined and it is proven that even under quite mild assumptions regarding the stochastic nature of the parameters of the model, it is equivalent to a convex programming problem. An algorithm is developed for solving the above convex programming problem. An approximate method is provided for solving a multi-stage capital budgeting problem under uncertainty. Author (TAB)

N69-27158# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMPUTER READOUT DEVICES FOR DATA ABOUT THE GEOMETRY OF AN OBJECT

G. A. Spynu et al 1 Mar. 1968 10 p Transl. into ENGLISH from Mekhaniz. i Avtomatiz. Upr. (Moscow), no. 5, 1966 p 15–17

(AD-683179; FTD-HT-23-1661-67) Avail: CFSTI CSCL 9/2

The operating principles of graphic data readout devices for computers are briefly reviewed. The first Soviet devices of this type are mentioned and the general requirements for graphic output devices are formulated. In 1959 the Institute of Automatics developed the first device for reading out information on the geometry of an article from an interpolater. The drive consisted of miniature step motors which rotate the lead screws and the moving parts. The control system was open discrete, the unit step was 0.2 mm, and the displacement velocity along the contour was 1.5 meters/min. On the basis of this device, an experimental device for graphic reproduction was developed. Extended exploitation of electromechanical devices for reading out information on the geometry of an article, and the extended investigation of Soviet and foreign units has made it possible to formulate basic requirements which must be satisfied by devices of this type. TAB

N69-27198# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHAIN-RING CODING METHOD

I. A. Naviev et al 23 Aug. 1968 10 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Sibirsk. Otd. Inst. Avtomat. i Elektr. Avtomatiz. Kontrol i Elektr. Izmereniya (USSR), v. 2, 1964 p 74–77

(AD-683156; FTD-HT-23-406-68) Avail: CFSTI CSCL 9/4

The article considers a coding method on the basis of a binary code, with which correcting properties are obtained without using a large number of supplementary digits. The method is based on the formation of a chain-ring group sequence possessing the following properties: (a) any symbol in an initial binary combination is repeated in d groups of the newly obtained chain-ring sequence. Here if two arbitrary binary combinations differ by at least one symbol, then the chain-ring combinations corresponding to them differ by at least d groups; (b) any two groups separated from one another by a definite number of groups are the nearest independent; i.e., have no common symbols. It is noted that when the chain-ring method is used, a large number of pulse signs must be introduced. Author (TAB)

N69-27201# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECIAL FEATURES OF THE EMPLOYMENT OF THE MINSK-222 SYSTEM INSTRUCTIONS

Yu. G. Kosarev et al 1 Nov. 1968 24 p refs Transl. into ENGLISH from Tr. Simpozium po Vychislitelnym Sistemam Novosib. (USSR), no. 24, 1967 p 41–54

(AD-683995; FTD-MT-24-405-68) Avail: CFSTI CSCL 9/2

The authors describe the design principles of the Minsk-222 system, which represents a uniform system with bilateral communication channels between elementary machines (EM). The system can include up to 16 EMs. Each EM consists of the Minsk-22 computer, a commutator, and a system operations unit. System commands are described which complement the system of Minsk-22 commands. These refer to the commands of adjustment, transmission, reception, general conditional transition, and general unconditional transition. The article considers cases of diverse (desirable and undesirable) interactions of system commands, and presents examples of the employment of system commands. The process of uniting subsystems into a single system and the regime governing the automatic reorganization of the system are analyzed.

TAB

N69-27221# Mound Lab., Miamisburg, Ohio.

COMPUTER MODEL OF THE AUTOREDUCTION OF Pu(VI)-238 UNDER THE INFLUENCE OF ITS OWN ALPHA-RADIATIONS

G. L. Silver 12 Feb. 1969 23 p refs

(Contract AT(33-1)-GEN-53)

(MLM-1581) Avail: CFSTI

The autoreduction of hexavalent ^{238}Pu under the influence of its own alpha radiations can be simulated by adjusting the rate of reduction of Pu(IV) by radiation-generated reducing agents and the rate of proportionation of Pu(III), Pu(IV), and Pu(VI) via the equation $3Pu(IV) \rightarrow 2Pu(III) + Pu(VI)$.

Author (NSA)

N69-27270# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

IMPROVEMENT OF THE X-Y CORE HEAT TRANSFER MODEL (MOXY) USING THERMAL SYMMETRY

D. R. Evans Dec. 1968 34 p refs

(Contract AT(10-1)-205)

(IDO-17283) Avail: CFSTI

Two versions of the core heat transfer code, MOXY, have been developed. Both simulate heat transfer in a BWR fuel element; one models a full section of the fuel element, the other a one-eighth section by using symmetry. The codes give the same results, but the code using symmetry uses 1/27th as much computer time on comparable problems and represents the section with 14 surfaces, rather than 81. On the basis of code performance, the symmetry model is a substantial improvement over the full section model.

Author (NSA)

N69-27291# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRELIMINARY PROCESSING OF CHARACTERS IN RECOGNITION SYSTEMS

A. A. Burlaka et al Oct. 1968 12 p refs Transl. into ENGLISH from the Publ. "Avtomaticheskoye Chteniye Teksta" Moscow, Vsesoyuz. Inst. Nauchn. i Tekhn. Inform., 1967 p 166–170

(AD-683545; FTD-HT-23-630-68) Avail: CFSTI CSCL 6/4

Several methods proposed by various authors for correcting distortions in typed characters are briefly reviewed. It is noted that typed characters differ primarily because of distortions caused by the composition of typewriter ribbon and paper, the ink color, and the presence of carbon paper. Consequently, the actual character outlines (on the paper) differ considerably from the ideal character and the reliability of their recognition by man or machine is reduced. In one of the schemes for correcting character distortion, for example, preliminary character processing at the recognition unit input i.e., quantization of the input signal at two or more levels with subsequent logical processing is proposed. In another scheme, the inclusion of the smoothing process into a character recognition algorithm is proposed. A three-dimensional-filtration method is described in greater detail. The essence of this method lies in the use, during the character-scanning process, of values of contrast function, not only from the scanning line but also from adjacent regions.

TAB

N69-27303# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

PARET: A PROGRAM FOR THE ANALYSIS OF REACTOR TRANSIENTS

C. F. Obenchain Jan. 1969 135 p refs

(Contract AT(10-1)-205)

(IDO-17282) Avail: CFSTI

PARET is a digital computer program designed for use in predicting the course and consequences of nondestructive reactivity accidents in small reactor cores. It is basically a coupled neutronics-hydrodynamics-heat transfer code employing point kinetics, one-dimensional hydrodynamics, and one-dimensional heat transfer. PARET has been shown to give consistently good agreement (10 to 30%) with experiment over a wide range of initial conditions for a slightly enriched oxide core. Less extensive comparisons with data for a highly enriched plate core indicate 20 to 40% agreement with experiment. The code was written in machine language for the IBM-7040 but is being converted to FORTRAN-IV. A detailed description of PARET, including both the basic theory and its application in the program calculations, as well as instructions pertaining to the general use of the program is presented.

Author (NSA)

N69-27306# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

WELL TRANSLATABLE GRAMMARS AND ALGOL-LIKE LANGUAGES

K. Culik 27 Aug. 1968 14 p ref Transl. into ENGLISH from Nauch. Tekh. Inform. Ser. 2: Inform. Protessy i Sistemy (USSR), no. 3, 1967 p 21–23

(AD-683105; FTD-HT-23-613-68) Avail: CFSTI CSCL 5/7

Languages are discussed which are generated by a contextless grammar with semantics assigned to them. For such languages, a distinction between translatability and good translatability is made. For a language that translates well into another language, an algorithm of the translation is constructed. The concept revealed could be useful in the description of the correspondences between artificial languages.

TAB

N69-27330# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant

APPLICATION OF A DIGITAL COMPUTER TO MECHANICAL TESTING

J. H. Smith 27 Feb. 1969 26 p

(Contract W-7405-ENG-26)

(Y-1663) Avail: CFSTI

A digital computer is being used to record raw data and to provide automatic data calculations for mechanical tests. The computer which is connected through an analog-to-digital converter to a universal testing machine and to a torsion tester, stores the raw load-strain data, converts it to stress-strain data, and calculates any of the mechanical properties desired from the test. The computer can also provide a printout and a paper tape, both of which contain the stress–strain data points and the calculated data. In addition, the load–strain data that are normally obtained from the test machine are still available. An oscilloscope display is obtained as the data are being recorded. Tests which are presently being performed using the computer are: tensile, compression, pin

bearing, double shear, and torsion. Data, which are being recorded include: ultimate strength, offset yield strength, elastic and shear moduli, energy under the stress–strain curve, and a mathematical expression for the stress–strain curve. Author (NSA)

N69-27334# United Kingdom Atomic Energy Authority, Harwell (England).
FORTRAN PROGRAMME FOR THE NUMERICAL SOLUTION OF PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS
J. T. Klaschka Oct. 1968 16 p refs
(AERE-R-5629) Avail: CFSTI; HMSO 3s

A FORTRAN IV computer program for the numerical solution of parabolic partial differential equations in one time and two space coordinates is described. The program has been implemented on the IBM system 360/65 computer. The program comprises a small main routine, which calls the major subroutine FDTD3. This major subroutine solves the equations and requires two minor subroutines FORMSB which contains the equations in finite difference form and UPDATE, which allow the modification of equation parameters during the computation. The program is designed to handle both linear and nonlinear equations, with uniform and nonuniform initial conditions and derivative or fixed boundary conditions. Tape and disk, reading and writing facilities are written into the program. Author (NSA)

N69-27371# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A CENTRALIZED SYSTEM FOR ACQUISITION AND PROCESSING OF INFORMATION (SOFI)
M. N. Ivanov et al. 19 Nov. 1968 32 p refs Transl. into ENGLISH from the Publ. "VI Nauchno-Tekhnicheskaya Konferentsiya po Yadernoy Radioelektronike. Analizatory, Bloki, Nakopleniya i Obrabotka Informatsii, V3" Moscow, Atomizdat., p 110–136
(AD-683998; FTD-HT-23-287-68) Avail: CFSTI CSCL 9/2

The operational principle and basic equipment of a centralized system for the assembly and processing of information are described in detail. The system consists of a memory core device, a control device, several input arrangements, an output arrangement and extension testing panels. The technical characteristics of the system are as follows: 2048 channels; channel volume, 2 to the 16th power; there are 8 input devices; interrogation period, 5 microsec; registration time of the number, 82 microsec; maximum registration frequency, 12,000 pulses/sec; data output speed with digital printout, 20 lines per sec; and the output speed on the perforator, 20 octal signs per second. The possibility of multi-dimensional measurements is foreseen. The design is of block type, with easily interchangeable parts. Logic elements are made with semiconductor devices. TAB

N69-27376# Colorado Univ., Denver. Medical Center.
DIGITAL COMPUTER ANALYSIS AND DISPLAY OF THE RADIOISOTOPE SCAN
David S. Groome and Donald W. Brown 27 Jan. 1969 55 p refs
(Contract AT(11-1)-1472)
(COO-1472-22) Avail: CFSTI

After a brief summary of the equipment used for data collection and processing, the various types of displays such as two-dimensional printer displays, two-dimensional printer displays with photography, isometric printer displays, and plotter displays are discussed. Data smoothing of isometric data is briefly examined. A method by which hidden lines have been removed from some of the isometric plots of scan data is described. NSA

N69-27433# Colorado Univ., Denver. Medical Center.
COMPUTER ANALYSIS OF THE RADIOISOTOPE SCAN Technical Progress Report
Donald W. Brown and David S. Groome 5 Feb. 1969 24 p refs
(Contract AT(11-1)-1472)
(COO-1472-23) Avail: CFSTI

An on-line computer system based on the IBM 1800 computer for analysis of data from radioisotope scanners is described. NSA

N69-27450# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPERATIONS CONTROL UNIT IN A SPECIAL PURPOSE DIGITAL COMPUTER
V. S. Kossovskii et al. 20 Feb. 1968 13 p refs Transl. into ENGLISH from Mekhaniz. i Avtomatiz. Upr. (USSR), no. 1, 1968 p 9–13
(AD-683274; FTD-MT-24-16-68) Avail: CFSTI CSCL 9/2

A list of instructions to be realized by the computer serves as initial data for designing the control unit which comprises a clock-pulse unit, a micro-operation control circuit, and an operation decoder. The clock-pulse unit produces pulses and sequentially distributes them among its trunks. The control circuit handles microprograms consisting of 38 micro operations (a 10-cycle microprogram table is shown). Ferrite-core circuits are used throughout. The control unit operates on a two-cycle principle (a read cycle for one group of cores serves simultaneously as a preparatory cycle for another group). The micro-operation control circuit comprises 5 core groups. The operation decoder is built on a two-step principle; first-step cores perform logical multiplication of the first three variables X1X2X3 of the operation; second-step cores, multiplication of the remaining two variables X4X5. The clock frequency can go as high as 30 kc; pulse height, 0.4 amp; pulse duration, 8 microsec. The above control unit exhibited reliable operation in conjunction with a laboratory model of a small-size control digital computer. TAB

N69-27471# Defense Documentation Center, Alexandria, Va.
COMPUTER-AIDED LOGICAL PROCESSES, VOLUME I Bibliography, 1953–1968
Dec. 1968 246 p refs
(AD-683600; DDC-TAS-68-77) Avail: CFSTI CSCL 9/2

The bibliography contains 186 annotated references concerning computer-aided logical processes. The references include all research dealing specifically with the processes of information handling and the application of fundamental mathematical theory to the construction or better understanding of information systems. The citations are grouped under six major headings: Computer logic; Biological information handling; Human factor information handling; Programmed instruction; Network and switching systems theory; and information, communication, and systems theory. All documents listed in the bibliography are available from CFSTI. Author (TAB

N69-27523# Sperry Rand Corp., Philadelphia, Pa. Univac Div.
FAN-IN CONSTRAINED LOGIC NETWORKS Final Report, 1 Jun. 1967–24 Nov. 1968
James T. Ellison Feb. 1969 107 p refs
(Contract F19628-67-C-0386)
(AD-683752; AFCRL-69-0012) Avail: CFSTI CSCL 9/5

Three topics are considered in this paper, switching-time minimization, the relationship of category theory to switching circuits, and the algebra of cellular arrays. Switching-time is related to the number of levels a logic net has, that is, the number of logic gates a signal must traverse in passing through the net. The object is to establish upper and lower bounds on the number of levels required to implement certain classes of Boolean functions, given that no more than r inputs can be handled by any element of the

net. It is shown that minimal level-requirements for n-variable Boolean functions range from approximately log of n to the base r to at least log of (2 to the (n-r) power) to the base r, never requiring more than approximately (n - r)/k levels, where k is the largest integer such that k + 2 to the kth power < or = r. Similar bounds are also found for universal functions for n variables; these are functions which can perform to an arbitrary Boolean function in n variables depending on the constants biasing a fixed subset of the inputs. All upper bounds are obtained by explicit construction of nets realizing them. It is shown that the ratio of upper bounds to lower bounds approaches one as r increases to infinity. In succeeding sections, categories and functors are defined which place switching theory in the framework of this increasingly important field, and it is shown that universal functions are the universal elements of a suitably defined functor. Finally, an algebra is defined which could provide a context for the investigation of cellular arrays. Author (TAB)

N69-27548# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.

AN APPARATUS WITH AUTOMATIC DATA HANDLING FOR STUDIES OF REACTIONS BETWEEN GRAPHITE AND FLOWING GASES UNDER IRRADIATION

D. A. Dominey, H. E. Evans, and B. Knight Dec. 1968 31 p refs

(RD/B/N-1142) Avail: CFSTI

An apparatus is described to study the effect of gamma radiation on reactions between graphite labelled with ^{14}C and CO_2 at pressures up to 3 MN/m^2 (400 psi), at temperatures between 400° and 700°K, and at flow rates down to 0.1 std. cm^3/min. The analytical apparatus is fully automatic and data are produced on punched tape. This is processed with a small desk computer for which programs were written. Author (NSA)

N69-27556# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH-SPEED MEASUREMENT AND LOGGING APPARATUS

A. V. Lebedev et al 11 Oct. 1968 13 p refs Transl. into ENGLISH from Pribory i Sistemy Upr. (USSR), no. 9, 1967 p 17–19

(AD-684008; FTD-HT-23-702-68) Avail: CFSTI CSCL 14/3

A transistorized data logging system consisting of two portable units and the BPU-20 printer is described. The system is able to handle 100 signals in 4 groups whether they are low-level such as from thermocouples, thermo-resistors, or strain gages or high-level signals such as from potentiometric transducers. These signals may be cyclically sampled or a certain group may be repetitively and exclusively sampled. An analog-to-digital converter using digital voltmeter circuits is used for code conversion. Data is displayed on a digital indicator panel or is printed by a 20 position printer having a continuously revolving drum. A 100 3-digit decimal numbers plus sign may be printed in one second. The system quantization error is equal to 0.1% and amplifier error is 0.5%. All logic elements used in the system are dc coupled. Provisions are made for storing data on magnetic tape and for direct transmission to data processing complexes including digital computers. TAB

N69-27568*# Massachusetts Inst. of Tech., Cambridge.

LAMBDA-CALCULUS MODELS FOR PROGRAMMING LANGUAGES

James Hiram Morris, Jr. (Ph.D. Thesis) Dec. 1968 122 p refs

(Contract Nonr-4102(01))

(AD-683394; MAC-TR-57) Avail: CFSTI CSCL 9/2

Two aspects of programming languages, recursive definitions and type declarations are analyzed in detail, using Churchs lambda-calculus as the programming language model. The main result on recursion is an analogue to Kleenes first recursion theorem: If A = FA for any lambda-expressions A and F, then A is an extension of YF in the sense that if E(YF), any expression containing YF, has a normal form then E(YF) = E(A). Y is Currys paradoxical combinator. The result is shown to be invariant for many different versions of Y. A system of types and type declarations is developed for the lambda-calculus and its semantic assumptions are identified. The system is shown to be adequate in the sense that it permits a preprocessor to check formulae prior to evaluation to prevent type errors. It is shown that any formula with a valid assignment of types to all its subexpressions must have a normal form. Author (TAB)

N69-27571# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ALGORITHMS EXECUTED BY RECURRENT APPLICATION OF FINITE AUTOMATIC MACHINES

V. A. Nepomnyashchii 22 Oct. 1968 12 p refs Transl. into ENGLISH from Diskretnyi Analiz (USSR), no. 5, 1965 p 77–82

(AD-683537; FTD-HT-23-697-68) Avail: CFSTI CSCL 6/4

We find the concept of C-sets and we are posed with the question: What is the significance of the class C-sets in the Ritchie hierarchy. We show that the class of C-sets corresponds to a class of sets recognized by the Turing machine with limited expansion. Author (TAB)

N69-27574# Computer Associates, Inc., Wakefield, Mass.

RESEARCH IN MACHINE-INDEPENDENT SOFTWARE PROGRAMMING. Semiannual Technical Report, 21 Jun.–21 Dec. 1968

T. E. Cheatham, Jr. and Carlos Christensen [1969] 37 p refs

(Contract DAHC04-68-C-0043; ARPA Order 1228)

(AD-683362; SATR-1) Avail: CFSTI CSCL 9/2

During the past decade the credibility gap in software specification and construction has widened alarmingly, while that in hardware specification and construction has narrowed until the time and cost of specifying and constructing rather major hardware systems now can be confidently predicted. The lessons learned from the software failure of many large-scale command and control systems, of major commercial and university time-shared and batch operating systems, and of attempts to provide complete language facilities such as promised by PL/I have not yet resulted in the development of a basic program construction technology which permits the prediction and control of software costs and facilities. The cost of construction of programs of large size or complexity on a one-shot basis is difficult to predict in any case. Of more importance, however, is the fact that even when a large program finally operates in an acceptable fashion the program is completely un-transferrable. The object of the current project is to develop solutions for these problems of software programming technology. The project activities consist of research into machine-independent techniques for programming computer software, of the design and implementation of certain specific language and system facilities, and of experimentation with the machine-independent specification and implementation of typical software components. Author (TAB)

N69-27588# California Univ., Los Angeles. Dept. of Engineering.

PROBLEM ORIENTED LANGUAGE AND A TRANSLATOR FOR PARTIAL DIFFERENTIAL EQUATIONS

A. F. Cardenas Nov. 1968 248 p refs

(Contracts ARPA SD-184; Nonr-233(52); AT(11-1)-GEN-10; Grant NSF GK-1758)

(UCLA-10P14-61; Rept-68-62) Avail: CFSTI

The success and popularity of digital computer simulation languages is exemplified by the acceptability and success of languages such as SIMULA, GPSS and SIMSCRIPT to solve and study discrete system problems, and MIMIC, DSL/90, CSMP and CSSL for continuous system problems characterized by ordinary differential equations. However, no high level problem oriented language solves the problems characterized by partial differential

equations; furthermore, conventional methods to handle such problems on a computer are very time consuming and generally cumbersome. Therefore, two main goals are accomplished: (1) a convenient, easy to learn and to use, high level problem oriented language to solve and study partial differential equation problems is designed and (2) a feasible translator for the language is designed, and a working version of it is actually constructed for a significant portion of the language. This language is named PDEL for *P*artial *D*ifferential *E*quation *L*anguage. Author (NSA)

N69-27693# National Bureau of Standards, Washington, D.C. Center for Computer Sciences and Technology.
SOME EVOLVING CONVENTIONS AND STANDARDS FOR CHARACTER INFORMATION CODED IN SIX, SEVEN, AND EIGHT BITS
John L. Little May 1969 31 p refs
(NBS-TN-478) Avail: SOD $0.35

Some of the properties of the USA Standard Code for Information Interchange, widely known as ASCII or USACII are described. This code is compared to similar international codes and presents the national code for Russia as an example of the worldwide acceptance of this code, which is comprised of seven information bits representing 128 coded characters. Some of the conventions which are evolving to relate these seven bit codes to six and eight bit computer codes are given, and conventions for extending the code to represent an unlimited repertoire of concepts are also given. Two alternate arrangements of the code table are shown to facilitate an understanding of its structure and application. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-26170# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PYRAMIDAL INFORMATION SYSTEM FOR ACQUIRING DATA FROM SENSORS AND FOR TRANSFERRING THEM TO A REMOTE COMPUTER
V. M. Ordyntsev, A. M. Arzhakov, E. E. Enyutina, L. P. Kulevatskaya, and V. M. Milyavskii 22 Oct. 1968 16 p refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 1, 1968 p 25–28
(AD-683962; FTD-HT-23-910-68) Avail: CFSTI CSCL 9/2

A data acquisition system was designed to gather data from as many as 5076 sensors (e.g., thermocouples, resistance thermometers, and strain gages) and transmit them, for further processing, to a computer located 1.5–2 km away. The data from sensors with associated amplifiers giving out voltages in the range from 0 to 25 v are sampled and converted to digital form (10 + 1 sign bit code) by a common A/D converter and transmitted by cable to a digital computer whose word length must be greater than 33 bits (e.g., the BESM-3M or the M-220). The minimize transmission errors the information is coded in the Hamming code. The sensors are divided into 30 groups. Switching between sensors is done at two levels: switching between groups, each having its own amplifier, and switching between individual sensors in these groups. Total time needed to sample all sensors is approximately 10 sec. The nonlinearity and instability of sensor amplifiers is compensated by the computer, which stores appropriate data in its memory and during each measurement cycle compares them with current information and resolves the discrepancies. Boolean equations describing this process are cited. Author (TAB)

N69-26221# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ANALYSIS OF ELECTRICITY CONTROLLED PHASED-ARRAY ANTENNAS IN THE PRESENCE OF MISMATCH BETWEEN RADIATORS AND THE PHASING SYSTEM
Yu. M. Bruk 10 Oct. 1968 36 p refs Transl. into ENGLISH from Antenny (USSR), no. 2, 1967 p 94–116
(AD-683981; FTD-MT-24-284-68) Avail: CFSTI CSCL 9/5

The calculated characteristics of two electrically steerable linear-phase-array antennas with different types of phasing systems, parallel and pyramided, are examined. In the calculations it is assumed that the antenna radiators are isotropic when fed with equal-amplitude signals and that the phasing systems do not have internal reflections or phase and amplitude errors. An analysis of the change in gain for both antennas as functions of the inclination angle shows that the gain, in the direction of the calculated maxima, are determined by the radiator reflection factors gamma and decrease according to the relationship (1 - /Gamma/ to the 2nd power). Although the reliabilities and efficiencies of the two antennas differ and vary as functions of the inclination angle, the changes of antenna gains do not vary with the inclination angle and are the same for both antennas. Author (TAB)

N69-26309# Air Force Cambridge Research Labs., Bedford, Mass.
A NOVEL CIRCULAR ARRAY ANTENNA
Frederick H. Cleveland, Nicholas P. Kernweis, and Peter R. French Nov. 1968 23 p refs *Its* Instr. Papers No. 152
(AD-683858; AFCRL-68-0582) Avail: CFSTI CSCL 9/5

A 2000-ft circular array antenna using radio stars as sources has recently been constructed and tested at Sudbury, Massachusetts. The array operates at 5.0 to 7.5 MHz and can electronically scan a 3-deg main beam with 8 dB side lobes. It is designed with a flat transfer function to experimentally examine data processing techniques using restoration and enhancement procedures. The report gives the complete description and theory of the array as well as the results of the calibration and testing. Author (TAB)

N69-26381 Rutgers Univ., New Brunswick, N.J.
HIGH-FREQUENCY CHARACTERISTICS OF THE INSULATED-GATE FIELD-EFFECT TRANSISTOR
Joseph Richard Burns (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-17753

A detailed analysis of the active channel of an insulated gate field effect transistor is used to characterize the performance of the device as a high frequency and a large signal switch. Closed form expressions determine the input admittance and transconductance as functions of frequency, d-c operating point, and transistor parameters. An approximate small signal equivalent circuit is obtained that predicts the unilateral power gain to within 1 db over the useful frequency range of the device. A comparison of the gain-bandwidth products of the bipolar transistor and the silicon insulated-gate (MOS) transistor shows that the MOS transistor is within a factor of 3 of an optimized germanium bipolar transistor in upper cut-off frequency. Analysis of operation under large signal conditions indicates a finite time delay in the drain current response to a step voltage applied to the gate terminal. Dissert. Abstr.

N69-26399 Carnegie-Mellon Univ., Pittsburgh, Pa.
ANALYSIS OF THE BANDLIMITED, SELF SYNCHRONIZING, PULSE AMPLITUDE MODULATED CHANNEL
Thomas Richard Armstrong (Ph.D. Thesis) 1968 204 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-17607

The matrix Z-transform method of PAM analysis developed by Pierce (1,2) is applied to the study of the PAM channel using a class of realistic, bandlimited pulse spectra; specifically, pulses whose spectra is a curbed cosine with various amounts of curbing. New theoretical results for such PAM channels include limits of channel capacity and efficiency, the number of received pulses necessary to attain a specified standard deviation of the timing error, and encoder-decoder approximations necessary for realizability. New numerical data for such PAM channels includes the calculation of receiver error, channel capacity and efficiency, and asymptotic performance of the maximum likelihood synchronizers, discussed previously (1,2). New design data for such PAM includes the calculation of the impulse response of the maximum likelihood synchronizers in some useful cases, as well as the impulse response for the least-mean-square-error decoder and the least-mean-square-error decoder without intersymbol interference. Dissert. Abstr.

N69-28419*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

[RESEARCH LABORATORY OF ELECTRONICS] Semiannual Status Report, 16 Nov. 1968–15 Feb. 1969

Paul Penfield, Jr. 20 Mar. 1969 4 p

(Grant NGR-22-009-337)

(NASA-CR-101138) Avail: CFSTI CSCL 09A

Emphasis is placed on the transient case of static negative resistance in avalamce diodes. A computer program has been written and refined, to simulate the behavior of such a diode as a function of time. It is possible to excite the diode with an arbitrary current waveform and view the resulting voltage, the electron, the hole profiles, and the electric-field profiles. A collection of the resulting profiles shows how the transient behaves. It is possible to consider the diode as excited through a circuit. Author

N69-28489*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

INVESTIGATION OF CONTINENTAL DRIFT. PHASE 2: EFFORT Final Report, 1 Oct. 1968–15 Mar. 1969

Mario D. Grossi 15 Apr. 1969 54 p refs

(Contract NSR-09-015-079)

(NASA-CR-101112) Avail: CFSTI CSCL 09E

Efforts were concentrated on designing a plan for an initial very long baseline interferometry (VLBI) observation program to evaluate the accuracy of selected interferometer configurations. This approach is intended to provide a means for quantitatively examining the effectiveness of the interferometer technique for a variety of earth measurements. Special emphasis was applied to the following areas of investigation: (1) a screening of existing radio antennas to determine those most suitable; (2) a preliminary analysis of the effects of major uncertainties on the accuracy achievable with a VLB interferometer; (3) for those sites of most interest, a check of available equipment for the acquisition, recording, and processing of the received signals; (4) an investigation of the adaptability of existing methods and instrumentation to the measurement of the columnar refractivity (atmospheric and ionospheric) along the ray path of the radio star; (5) a survey of natural and artifical radio sources to determine those most suitable; (6) further investigations toward improving the data processing capabilities for reducing the received signals; (7) a formulation of a draft plan for a schedule of observations. A summary of recent geological findings is included. Author

N69-28503*# Texas Instruments, Inc., Dallas.

RELIABILITY HANDBOOK FOR SILICON MONOLITHIC MICROCIRCUITS. VOLUME 4: RELIABILITY ASSESSMENT OF MONOLITHIC MICROCIRCUITS

Jim D. Adams et al. Washington NASA May 1969 99 p refs

(Contract NAS8-20639)

(NASA-CR-1349; TI-03-67-04) Avail: CFSTI CSCL 09A

In this volume, reliability concepts and data are defined, and reliability is examined from the point of view of device type, manufacturing methods, mean life characteristics, mechanical and thermochemical stresses, severe overstress capabilities, and parameter stability. Failure rate information is presented for each family of monolithic microcircuits, for operation at maximum rated conditions, and at temperatures of 85°C, 55°C, and 25°C. A curve is used for extrapolation of failure rate at maximum rated conditions over the range from 0°C to 125°C. Where the failure rate of a specific monolithic microcircuit in one of the mentioned families is significantly different from the average of that family, the circuit and its failure rate are identified. K.W.

N69-28586# Fairchild Semiconductor Corp., Mountain View, Calif.

RADIATION STUDY ON MOS STRUCTURES Final Report, 15 Dec. 1965–14 Dec. 1968

E. H. Snow, H.-P. Albus, S. F. Cagnina, D. J. Fitzgerald, W. L. Kauffman et al. Jan. 1969 171 p refs

(Contract AF 19(628)-5747)

(AD-683777; AFCRL-69-0045) Avail: CFSTI CSCL 9/1

The effects of ionizing radiation on metal-oxide-silicon (MOS) field-effect devices have been studied. Two permanent surface effects -- space-charge build-up in the passivating oxide and an increase in the fast surface stage density -- are characterized in detail and a trapping model is presented. This report describes the results of a detailed study of the above two effects using low and high energy electrons, X-rays and ultraviolet light. Planar diodes, bipolar transistors, MOS transistors, and junction field-effect transistors have been exposed to ionizing radiation and the results interpreted in terms of the two surface effects. In addition, these device types were subjected to neutron irradiation and the relative importance of surface and bulk effects determined for each device. Author (TAB)

N69-28623# California Univ., Berkeley. Electronics Research Lab.

ELECTROMAGNETIC WAVE-CHARGE INTERACTION IN CROSSED FIELD Quarterly Progress Report, 16 Aug.–15 Nov. 1968

K. A. Fox, S. Swierkowski, T. Van Duzer, and K. Weller Feb. 1969 51 p

(Contract DAAB07-67-C-0227)

(AD-683596; ECOM-0227-6; QPR-6) Avail: CFSTI CSCL 9/1

The construction of a crossed-field amplifier which will incorporate the results of our noise studies is in progress. A flattened-helix circuit suspended on sapphire rods is being used with a beam originating from a Kino short gun. Work on the crossed-field gun design method developed by R. A. Rao is being carried on to obtain designs for magnetically shielded guns. An experimental and theoretical evaluation of the crossed-field acoustic-wave amplifier is being conducted. The comparison of optimum performance of ZnO longitudinal acoustic amplifiers with the InSb crossed-field counterparts has continued with an effort being made to get an improved basis for comparison in heat dissipation capabilities. A detailed study of the dc electron flow under crossed-field conditions has been made. Conditions at the ends of the semiconducting bar are such that there are significant effects on the electron velocity parallel to the direction of the acoustic-wave beam. The effects on the gain and direction of the amplified acoustic wave are studied. Author (TAB)

N69-26651# Illinois Univ., Urbana. Dept. of Computer Science.
LOGICAL DESIGN OF AN OPTIMAL NETWORK BY INTEGER LINEAR PROGRAMMING, PART 1
Saburo Muroga and Toshihide Ibaraki 18 Jul. 1968 49 p refs
(PB-180029) Avail: CFSTI CSCL 09E

Logical design of an optimal network by integer linear programming is formulated. Various restrictions on a network are easily incorporated and how to incorporate them is discussed. The number of gates, the number of levels or one of other parameters of a network can be minimized. A network of multiple outputs is also easily treated. The formulation is based on threshold gates, since threshold gates are the generalization of conventional switching gates, such as AND, OR and NAND gates. The formulation of designing a network of conventional gates can be easily derived from this general formulation. As an example, design of an optimal network with NOR gates is discussed in some detail.
Author (TAB)

N69-26660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-SPEED IMMEDIATE-ACCESS STORAGE UNIT (BOZU) ON TUNNEL DIODES WITH ASSOCIATIVE ADDRESS SELECTION
Ya. N. Pavlovskii and R. S. Dokin 1 Mar. 1968 19 p Transl. into ENGLISH from Pribory i Sistemy Avtomatiki (USSR), no. 14, 1966 p 123–132
(AD-683288; FTD-MT-24-43-68) Avail: CFSTI CSCL 9/1

The basic principles of BOZU construction, the basic circuits of a number storage unit and an address storage unit with associative selection on tunnel diodes are examined. The basic characteristics of these units, their designs and requirements on the tunnel diodes are given.
Author (TAB)

N69-26668*# Texas Instruments, Inc., Dallas.
THE DEVELOPMENT OF QUALITY STANDARDS FOR BIPOLAR LSI Quarterly Report, 15 Jul.–15 Oct. 1968
Bryan E. Zimmerman Nov. 1968 67 p ref
(Contract NAS8-21319)
(NASA-CR-98434; TI-03-68-88; QR-2) Avail: CFSTI CSCL 09A

The following work is described in this report: (1) compilation of a list of inspection and defect criteria, including possible causation; (2) results of storage and operating-life tests, with some variables data on logic arrays; (3) a summary of present capabilities and problems in performing environmental tests on large-array packages; (4) a study of some theoretical aspects of intercellular dependency; and (5) an example of the use of Bayesian statistics in qualification testing.
K.W.

N69-26686# Montana State Coll., Bozeman. Electronics Research Lab.
CELLULAR BULK TRANSFER SYSTEMS Final Report, 4 May 1967–3 Sep. 1968
Robert C. Minnick, Kenneth J. Thurber, Amar Mukhopadhyay, and Kalyan K. Roy 3 Oct. 1968 159 p refs
(Contract F19628-67-C-0293)
(AD-683744; AFCRL-68-0497) Avail: CFSTI CSCL 9/2

The report is divided into three parts. Part A is entitled Fault Location in Cellular Arrays. A detailed consideration is given to establishing efficient tests for locating faults in cellular arrays. The assumptions are made that access can be made for testing purposes only at the edges of the array, and that the number of required tests must be kept within practical limits. Part B is entitled Unate Cellular Logic. By removing the dyadic functions of exclusive-or and identity from the allowable set in a single cell, it was found that the cascade functions are unate. Much of the established knowledge on unate switching functions was found to be applicable to such cellular arrays. Part C is entitled Bulk Transfer Logic. Principles of abstract algebra are applied to the problem of mapping one cellar array onto another cellular array.
Author (TAB)

N69-26706*# General Precision Inc., Wayne, N.J. Electronics Dept.
INTEGRATED 10 WATT AMPLIFIER
G. K. Gelfend [1968] 100 p
(Contract NAS8-20846)
(NASA-CR-98444) Avail: CFSTI CSCL 09C

The design, development, and testing of the integrated amplifier and power module are reported. The circuit is described, and the results of electrical, vibration, and nuclear radiation tests are discussed. It was concluded that the modules meet specifications, and a compromise between frequency response and slew rate is recommended.
N.E.N.

N69-26735# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE URP-1 DEVICE FOR DECIPHERING PUNCHED CARDS
K. K. Beletskii May 1968 12 p Transl. into ENGLISH from Pribory i Sistemy Upr. (USSR), no. 3, 1967 p 32–34
(AD-682439; FTD-MT-24-123-68) Avail: CFSTI CSCL 9/2

An 80-column punched card reader whose construction is based on the K80-6 card verifier is described. The urp-1 reader decodes punched apertures and simultaneously prints this information (number from 0 to 9) at a speed of 10 characters/sec on the 12th card row. the urp-1 unit contains an input hopper, card stacker, multiple pass unit, transport unit, reading station, printing station, and control and power supply units. The reading is accomplished by means of ten photodiodes. The printing unit does not use a ribbon; instead, the print wheel is supplied with ink (through a system of rubber rollers) from a felt roller which is dipped in ink every 10,000 cards. The operation of the card reader is described and mechanical details are presented. At present, urp-1 units are being tested in a laboratory and preparations are being made for their mass production.
Author (TAB)

N69-26764# Israel Program for Scientific Translations, Ltd., Jerusalem.
A RESONATOR FILLED WITH AN ARTIFICIALLY ANISOTROPIC DIELECTRIC
L. N. Baranov et al *In its* Ukrain. Phys. J., vol. 12, no. 3 1967 p 431–437 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The principal results of the theory of resonators with an artificially anisotropic dielectric are presented and an experimental verification of the theory is carried out. Measurements were made of the resonance frequency, Q factor, shunting resistance and dispersion properties on a resonator stacked with titanium dioxide dielectric disks.
B.P.

N69-26808 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE SURFACE STATE PROPERTIES OF DENDRITIC WEB SILICON
Robert Rudolf Ferber (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-17647

Devices fabricated on as-grown web surfaces have failed to achieve the characteristics attainable by fabrication of the same device on chemically prepared ingot silicon surfaces. The electrical surface state differences existing between web and comparable ingot material surfaces are investigated by means of low frequency ac field effect techniques in a vacuum environment. It is found that, in general, there is slightly more than a factor of two

higher charged surface state density existing on web surfaces as compared to ingot material surfaces. An attempt has been made to correlate the web surface state density with the sub-surface dislocation structure on the premise that this dislocation structure can be used as an indicator of the amount of frozen in strain existing at the web surface. A reasonably strong positive correlation is observed in this work. Dissert. Abstr.

N69-26885 Cornell Univ., Ithaca, N.Y.
THE LIMITED SPACE CHARGE ACCUMULATION MODE IN GaAs
Wilbert Keith Kennedy, Jr. (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-16752

The generation of large pulse microwave power with the limited space charge accumulation (LSA) mode in gallium arsenide is discussed. The theory of the LSA mode is reviewed, and a theoretical circuit analysis is presented. The GaAs device was represented by a nonlinear current-voltage characteristic. A digital computer investigation of device performance as a function of the circuit energy storage, load resistance, and voltage pulse rise time was made for this model. Good agreement was obtained between the theoretically predicted values of efficiency and the maximum experimental efficiency. The experimental results for the LSA operation are presented. The prevention of high-field domains in order to permit LSA operation at average electric fields several times above the switching voltage is discussed. Dissert. Abstr.

N69-26902 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE EFFECTS OF TRAPS ON THE CAPACITANCE OF SELENIUM SCHOTTKY BARRIER DIODES
Robert H. Krambeck (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-17635

Capacitance measurements were made on selenium Schottky barrier diodes with the objective of extracting information on traps. The diodes were made by evaporation of nickel onto one face of a single crystal selenium chip to give an ohmic contact, and the evaporation of aluminum, silver, or magnesium onto the other face to give a blocking contact. Capacitance versus dc bias measurements gave a straight line for $1/C^2$ versus applied voltage and indicated a charge density in the depletion region that depended on annealing. Capacitance versus frequency measurements showed a ratio of high frequency to low frequency capacitance of about .02, indicating the probable existence of traps in the depletion region. An analysis of the effect of traps on junction capacitance was carried out. The behavior of capacitance after a source of light is removed is also analyzed, and experimental verification of the analysis is obtained. Dissert. Abstr.

N69-26937# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS OF PULSE MAGNETIC REVERSAL OF FERRITES WITH RECTANGULAR HYSTERESIS LOOPS ORIGINATING DURING THE USE OF MEMORY ELEMENTS IN MULTIPERFORATED SHEETS
R. A. Lashevskii 29 Feb. 1968 11 p refs Transl. into ENGLISH from Russian Conf. Proc. Presented at 4th All-Union Conf. on Ferrites: Physical and Physico-Chem. Ferrite Properties, Minsk, 1968 (AD-683284; FTD-HT-23-1531-67) Avail: CFSTI CSCL 9/2

Impulse magnetic reversal of multiperforated ferrite sheets used in memory circuits was studied. Diagrams of a typical circuit and of a cross sectional view of a sheet with magnetic and inductive field distributions are shown. The effect of current flowing through a perforation on the magnetic flux near adjacent elements was examined. TAB

N69-26940*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOUNTING OF COMPONENTS TO PRINTED WIRING BOARDS
E. Ray Van Orden 15 Apr. 1968 29 p
(NASA-TM-X-53731) Avail: CFSTI CSCL 09E

A Solder Committee designated to investigate a solder cracking phenomenon occurring on the Saturn electrical/electronic hardware found the cause to be induced stress in the solder termination rather than faulty soldering techniques. The design of the printed wiring board (PWB) assemblies did not allow for thermal expansion of the boards that occurred during normal operation. The difference between the thermal expansion properties of the boards and component lead meaterials caused stress and cracking in the soldered joint. Various PWB component mounting configurations are presented. Future design considerations to provide adequate strain relief in mounting configurations are included to ensure successful solder terminations. Author

N69-26984# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A MULTISTAGE PROCESS FOR THE SELECTION OF OPTIMUM DIMENSIONS FOR ELECTRICAL MACHINES
Dzh. A. Avetisyan et al 23 Feb. 1968 20 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 6, 1966 p 69-74 (AD-683276; FTD-HT-23-72-68) Avail: CFSTI CSCL 9/3

The paper considers the problem of the optimal design of electrical machines a general problem of nonlinear programming in a formulation such as to permit the use of modern computers employing mathematical programming techniques. Methods for finding the maximum function of many variables (limited and unlimited search methods) are briefly reviewed. A multistage process is proposed for the solution of optimization problems, with primary attention given to the logical structure of a multistage computer model. The consecutive approximation method underlying the multistage search process is analyzed, and it is shown how such computer models for any number of unknown variables can be described. TAB

N69-27001# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ABSOLUTE QUANTUM YIELD DUE TO THE INTERNAL PHOTOELECTRIC EFFECT IN CHEMICALLY-DEPOSITED PbS FILMS
I. D. Rogovoi 18 Nov. 1968 11 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), v. 35, no. 1, 1968 p 7-9 (AD-684002; FTD-HT-23-610-68) Avail: CFSTI CSCL 9/1

Results are presented of an investigation of the spectral distribution of absolute quantum yield of chemical PbS layers used in the production of PbS photoresistors. TAB

N69-27015# Rensselaer Polytechnic Inst., N.Y.
A VANADIUM OXIDE FILM SWITCHING ELEMENT
T. N. Kennedy and F. M. Collins Feb. 1969 30 p refs
(Contract N00014-67-A-0117)
(AD-683368; TR-2) Avail: CFSTI CSCL 9/5

Vanadium dioxide films were sputtered onto alumina substrates by a radio-frequency method. The films were heat-treated at 600C to insure good crystallinity. At 68C, the resistivity changed sharply at this so-called metal-semiconductor transition temperature. The resistance of the films can also be switched under an applied voltage through essentially a thermal process. For an applied voltage of 200 volts, for instance, the estimated transition time is of the order of a fraction of a microsecond. Author (TAB)

N69-27018*# Isotopes, Inc., Baltimore, Md.
MODIFICATION OF GOVERNMENT OWNED THERMIONIC LEAD CAPSULE TIE-I-3 Final Report 19 Jul. 1967–20 Sep. 1968
James D. Long Oct. 1968 180 p refs
(Contract NAS3-11123)
(NASA-CR-72539; ISD-3004) Avail: CFSTI CSCL 09A

The modification was primarily in the capsule instrumentation. It consisted of relocating an hermetic seal four additional feet away from the core, installing more reliable thermocouples, and installing two high quality emitter thermocouples in a protective atmosphere. The two emitter thermocouples are contained in an emitter cavity insert which protects the thermocouples and at the same time reduces the volume of this cavity. Several minor structural modifications were made to eliminate a thermal expansion problem in the original capsule design. After capsule modification and reassembly, the diode was operated in a test fixture which simulated all in-pile conditions except gamma heating. The diode performance was quite similar to previous data. The power output at 1500°C, optical pyrometer measured emitter temperature, was 2 watts/cm^2. A set of performance graphs was compiled and are included. Author

N69-27052# California Univ., Berkeley. Electronics Research Lab.
RESEARCH IN EXPERIMENTAL AND THEORETICAL PHYSICS Final Report, 1 Jun. 1965–31 Dec. 1968
R. S. Muller Feb. 1969 15 p refs
(Contract DA-31-124-ARO(D)-385)
(AD-683612) Avail: CFSTI CSCL 9/1

The research involved the study of field-effect devices. The two primary areas were: (1) analysis involving the important silicon metal-oxide-semiconductor field-effect transistors (MOSFET) and (2) consideration of novel field-effect devices. Since MOSFETs frequently are used with degenerate carrier concentrations in the channel, Fermi-Dirac statistics, rather than Maxwell-Boltzmann statistics, are appropriate in the analysis. Author (TAB)

N69-27100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING THE RELIABILITY AND EFFICIENCY OF RADIO ELECTRONIC APPARATUS: A HANDBOOK
V. A. Lutskii 14 Nov. 1968 162 p refs Transl. into ENGLISH of the book "Raschet Nadezhnosti i Effekt. Radioelektronnoi App." Kiev, Naukova Dumka, 1968 p 1–208
(AD-683581; FTD-HT-23-493-68) Avail: CFSTI CSCL 17/2

The manual discusses methods of evaluating quantitative indices of reliability of radio and electronic systems and elements, at various rules of time distribution, for trouble-free operation. It presents generalized data tables to help determine equipment reliability indices, taking into account the effect of operating conditions and electric load of the elements, according to the time distribution law of the indices. Particular attention is given to the evaluation of reliability indices (discounting the shift of operation parameters) and error magnitude-effectiveness and mean losses, which become indispensable in investigating the reliability of complex systems. The analysis of reliability-index calculation is illustrated by detailed examples. In conclusion, the methods of increasing the reliability of radioelectronic equipment are discussed and comparative evaluation of such methods given. Author (TAB)

N69-27257# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
RELIABILITY OF MILITARY CRYSTAL UNITS UNDER CLIMATIC ENVIRONMENTAL CONDITIONS
Lewis Nelson Nov. 1968 32 p refs
(AD-683460; ECOM-3066) Avail: CFSTI CSCL 9/1

The report presents the results of a 4-1/4-year investigation on military quartz crystal units in the HC-6/U enclosure which have been stored under moderate climatic environmental conditions. Crystal units being reported upon operated on their fundamental, third and fifth overtone modes and covered the frequency range of 4.3 to 100.0 MHz. Data on crystal aging and changes in resistance are discussed. Apparent manufacturing defects which result in crystal unit failures are explained. Author (TAB)

N69-27322# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FERRITES FOR RADIO FREQUENCIES
N. N. Sholts and K. A. Piskarev 1 Mar. 1968 239 p refs Transl. into ENGLISH of the book "Ferrity Dlya Radiochastot" Moscow, Energiya, 1968 p 1–258
(AD-683217; FTD-HT-23-1471-67) Avail: CFSTI CSCL 11/7

This book is intended for engineers and technicians engaged in the study of ferrites, their production, and uses in radio and electronic equipment. The basic parameters characterizing the quality of low-coercitive ferrites are discussed, methods of determining these parameters are described, and the physical and chemical principles of soft-magnetic ferrite technological processes presented. Author (TAB)

N69-27359# Sandia Corp., Albuquerque, N.Mex.
RADIATION TOLERANCE OF MOS DEVICES
C. W. Gwyn [1968] 7 p refs Presented at the IEEE Intern. Conv. and Exhibition, New York
(SC-DC-68-2542; CONF-690309-2) Avail: CFSTI

A previously held assumption that MOS transistors are less vulnerable to nuclear radiation is shown to be inaccurate. The radiation induced processes in MOS devices are discussed. Methods of obtaining hardened devices are examined. NSA

N69-27422*# Research Triangle Inst., Durham, N.C.
SEMICONDUCTOR p-n JUNCTION STRESS AND STRAIN SENSOR
Jimmie J. Wortman, and Ralph R. Stockard, inventors (to NASA) Issued 11 Mar. 1969 (Filed 6 Sep. 1966) 5 p Cl. 317-234 5 p Cl. 317–234
(NASA-Case-XLA-4980; US-Patent-3,432,730; US-Patent-Appl-SN-577548) Avail: US Patent Office CSCL 09A

A semiconductor p-n junction is described on the apex of a needle which can be used to detect stresses and strains. Two configurations are considered: (1) a needle of one type of semiconducting material coated with another type to form a p-n junction. (2) same configuration as (1) with an added coating of a metal. In the operation of either of the two embodiments, the apex is forced against a conducting surface by the force that is to be measured. This force is transmitted to the p-n junction which changes the electrical characteristics of the p-n junction. The measurement of this change in electrical characteristics is a measurement of the force. NASA

N69-27435# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
UNITARY SORTING AND DEPENDABILITY OF PLANAR TRANSISTORS UNDER IRRADIATION-RESTORATION CYCLES
Himcha Benbadis (Tex. Instr., France), Jacques Ghirlanda (Tex. Instr., France), Andre Blin and Jacques Le Ber [1968] 23 p refs In FRENCH Presented at the Intern. Symp. on Reliability of Electron Components, Grenoble, France, 6 Nov. 1968
(CEA-CONF-1145; CONF-681118-1) Avail: AEC Depository Libraries

The effect of a unitary sorting on the behavior of transistors exposed to irradiation-restoration cycles and then to standardized stresses in order to show an eventual degradation of their stability for classical stresses was evaluated. The results of the experimental study showed a similarity of the behavior of the standard and high reliable lots of transistors; PNP transistors have, however, a higher tolerable dose. The irradiation-restoration cycles produce a unitary sorting which eliminates the marginal or doubtful elements. The stresses during the cycle do not degrade the reliability of the transistors. These elements are not more stable than the standard non-treated elements. A unitary selection procedure is proposed. Author (NSA)

N69-27437# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
COORDINATION OF ACTIVITIES IN THE FIELD OF ELECTRONICS AND INSTRUMENTATION [COORDINAMENTO DELLE ATTIVITA NEL CAMPO DELL ELETTRONICA E DELLA STRUMENTAZIONE]
B. Rispoli 1968 122 p refs 2 Parts in ITALIAN and 1 Part in ENGLISH
(RT/EL-(68)4; Rept-4) Avail: AEC Depository Libraries

Three studies are included, concerning (1) a preliminary investigation on electrical conductivity in organic polymer films (2) a study of the first and second harmonic in a ferrite core, with the purpose of examining the possibility of developing adaptive components on the principle of second harmonic distortion, and (3) the development of a low noise, high stability charge preamplifier for nuclear spectrometry with semiconductor detectors. P.A.B.

N69-27463*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RING COUNTER
Frederick J. Kopetski, inventor (to NASA) Issued 8 Apr. 1969 Filed 23 May 1966) 7 p Cl.307-222
(NASA-Case-XGS-3095; US-Patent-3,437,832; US-Patent-Appl-SN-552344) Avail: US Patent Office CSCL 09C

A semiconductor ring counter circuit is described for use in counting, dividing, multiplexing, and sequencing applications. Pulse steering and gating techniques are used so that ring stepping is accomplished directly by the leading edge of the triggering pulse. This versatility enhances monolithic-type ring constructions, and the component design of the ring is compatible with the monolithic construction techniques. Official Gazette of the U.S. Patent Office

N69-27500# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID STATE SWITCH
Alden L. Schloss and Robert A. Booth, inventors (to NASA) Issued 25 Feb. 1969 (Filed 30 Sep. 1966) 9 p Cl. 307-136 (NASA-Case-XNP-9228; US-Patent-3,430,063, US-Patent-Appl-SN-584070) Avail: US Patent Office CSCL 09C

A solid state switching circuit is disclosed in which the switching of a normally open contact to a closed position is controlled, by sensing the potential across it with a difference amplifier, to permit the closing of the contact only when the potential difference across the contact does not exceed a preselected value. Utilizing the switch described, low rated contacts can be used to supply relatively heavy currents to loads from voltage sources whose open circuit voltage is many fold greater than the contact's open circuit voltage rating. NASA

N69-27506# Commissariat a l'Energie Atomique, Paris (France).
STUDY OF TIME RESOLUTION IN GERMANIUM (LI) COAXIAL DETECTORS [ETUDE DE LA RESOLUTION EN TEMP DETECTEURS GERMANIUM (LI) COAXIAUX]
G. Haoust, J. Lachkar and J. Sigaud [1968] 15 p refs In FRENCH Presented at Intern. Symp. on Nucl. Electron., Versailles, France, 10 Sep. 1968
(CEA-CONF-1179; CONF-680906-17) Avail: AEC Depository Libraries

A study was made to determine the quality of the time information that a large volume Ge(Li) coaxial detector open at both ends could provide. The distribution function of the pulses was determined. This makes possible the calculation of the mean value of the collection time and its fluctuations. The influences of the location of the detection, of the direction of the scattered electron, of the discrimination threshold, the polarization voltage, and the counting rate on the time definition are considered. The theoretical predictions are in good agreement with the experimental results. Some criteria of good operation are derived and justified. Author (NSA)

N69-27587# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
INVESTIGATION OF PERFORMANCE OF PIN SILICON DETECTORS
J. Stevens, R. B. Knowles, and W. John Jun. 1968 29 p
(Contract AT(29-1)-1183)
(EGG-1183-2183; S-67-TN) Avail: CFSTI

Three types of pulsed measurements were performed to determine the performance of PIN silicon detectors used to measure x-ray flux. The first was a time-response measurement for 5-nsec X-ray excitation. The second measurement was the determination of the effect of pulse width on detector sensitivity, which was made for pulse widths between 5 nsec and 4 μsec. The third measurement was the effect of peak output current on the detector linearity. NSA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-26491 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STUDY OF ANOMALOUS FARADAY ROTATION IN FERRITE LOADED WAVE GUIDES
Albert Riker Plantz (Ph.D. Thesis) 1968 263 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 68-17632

Faraday rotation in ferrite loaded circular wave guides is studied. This Faraday rotation shows sudden large departure from expected values. Measurements of Faraday rotation are made, using an X band microwave bridge with a circular wave guide section, in such a way that the reflected as well as the transmitted Faraday rotation can be measured. The theoretical analysis of the wave guide configuration studied is accomplished by numerically matching exact solutions to Maxwell's equations across boundaries within the wave guide. The numerical boundary matching is accomplished using a high speed digital computer. Dissert. Abstr.

N69-27074# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF A SEMICONDUCTOR MASTER OSCILLATOR FOR A THREE-CELL INVERTER

M. V. Gelman et al 21 Nov. 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Elektromekhan. (Novocherkassk), no. 2, 1966 p 223–225
(AD-684019; FTD-HT-23-1058-68) Avail: CFSTI CSCL 9/3

An investigation of a master oscillator, the master stage of which consisted of a three phase semiconductor converter with one master cell and two slave cells, was made; slave cells were synchronized by feeding part of the collector coil voltage of the master cell to the collector coil circuit of the slave cell transformers. The investigation demonstrated that the master oscillator could provide independent frequency and control pulse duration regulation while ensuring a high degree of ignition precision and improved conditions of the gate. Author (TAB)

N69-27166# Weapons Research Establishment, Salisbury (Australia)
THE COMPUTATION OF WAVEGUIDE FIELDS AND CUT-OFF FREQUENCIES USING FINITE DIFFERENCE TECHNIQUES
D. H. Sinnott Jan. 1968 29 p refs
(WRE-TN-PAD-158) Avail: CFSTI

The computation of fields and cut-off frequencies of cylindrical waveguides by finite difference techniques leads to a matrix eigenvalue problem. Iterative schemes for the solution of this matrix problem are examined and a practical scheme for successive over-relaxation is presented. The optimum accelerating factor is estimated as the iteration proceeds so that the process is close to optimum. The finite difference solution is used as a basis for interpolating a continuous field function from which a close upper bound on the waveguide cut-off frequency can be obtained. Applications of these techniques are given in the computation of cut-off frequencies of ridge waveguide and metal plate phase shifters (circular polarizers) in circular guide. Author

N69-27372*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
RESEARCH ON NEW TECHNIQUES FOR THE ANALYSIS OF MANUAL CONTROL SYSTEMS Progress Report, 16 Jun.–15 Dec. 1968
George A. Bekey and Michael J. Merritt Jan. 1969 20 p refs
(Grant NGR-05-018-022)
(NASA-CR-101171; USCEE-340; PR-7) Avail: CFSTI CSCL 05H

This dissertation is concerned with estimation of parameters in systems that have internal sampling, but have continuous input and output. The continuous portion of the sampled-data system is given by the differential equation $dz/dz = f(z, p, u(t))$; $z(t=0) = \zeta$ where z is an n dimensional vector of state, $f(\cdot)$ is the n dimensional vector of the dynamical system, p is a constant h dimensional vector of parameters, $u(t)$ is an r dimensional vector of piecewise continuous control functions, and ζ is the initial condition vector. For our results, $f(\cdot)$ was required to be of class C^1 in z and p. The differential equation is preceded by some form of data hold. The model-matching technique was used for parameter estimation. Methods were developed for determining not only the sampling interval, but all the other parameters and initial conditions of the sampled-data system as well. In all methods, the cost function was the integral of norm-squared error, where the error function was defined as the difference between the observed state vector of the system, and the state vector of the model. Author

N69-27377# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ON THE ELECTRICAL STRENGTH OF THE ACCELERATING RESONATOR OF HIGH-CURRENT MICROTRON
I. M. Metlova and R. V. Kharʹyuzov 1968 11 p refs In RUSSIAN
(JINR-P9-4206) Avail: AEC Depository Libraries

The experimental data are given characterizing the effect of the residual gas pressure and operating conditions of the thermonic cathode on the lifetime of the high-current microtron resonator. The construction of the resonator is described in which unavoidable bombarding of the cathode cover with the ballast electrons occurs at the bottom of a special groove into which the powerful SHF field of the resonator does not penetrate. The electrical strength of the gap of such a resonator is considerably higher than of an ordinary one. Author (NSA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-26358# Federal Aviation Agency, Atlantic City, N.J.
FLIGHT TEST AND EVALUATION OF HELIPORT LIGHTING FOR VFR Final Report
Richard L. Sulzer and Thomas H. Paprocki Mar. 1969 92 p refs
(AD-683680; FAA-RD-1968-61; NA-69-2) Avail: Issuing Activity CSCL 1/5

The guidance value of heliport lighting system components was tested under VFR conditions. The overall system included lighting to identify and locate the heliport and support the approach and landing of helicopters. Forty-six civil and military pilots flew on 11 nights at Tipton Army Airfield, Fort Meade, Maryland, producing the following conclusions: The heliport beacon, flashing green-yellow-white, had adequate range and distinctiveness but could be improved by a change in flash rate; the yellow pad perimeter lighting met all requirements; the white approach direction and yellow landing direction lighting components were satisfactory; both pad surface floodlighting and pad inset lights were used satisfactorily, and all pilots who were shown the painted maltese cross marking rated it as an aid at night; the lighted wind sock provided adequate wind direction information if overflown first, but neither the lighted wind sock nor the lighted wind tee tested were adequate to provide this information to a pilot on the approach path at one-half mile from the pad. A minimum VFR heliport lighting system is recommended to include the beacon for location information, the perimeter lights and painted marking for pad identification, and the lighted wind sock to provide wind information. Other components are recommended for installation when required by special conditions. Author (TAB)

N69-26720# Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF LINEAR ACCELERATORS
A. D. Vlasov 1968 257 p refs Transl. into ENGLISH of the book "Teoriya Lineinykh Uskoritelei" Moscow, Atomizdat, 1965 Published for AEC and NSF *Its* Cat. No. 1824
(TT-68-50322; AEC-tr-6718; UC-28) Copyright. Avail: CFSTI

A comprehensive systematic discussion of the elements of modern proton and electron lineacs is presented. Emphasis is placed on the theory of proton accelerators. Rigorous analysis of th longitudinal motion of particles, defocussing forces and focusin techniques, quadrupole focusing, alternating gradient focusin

longitudinal focusing, as well as grid and foil focusing are the main topics considered. Treatment of the general theory of electron accelerators is followed by a discussion of tolerances and high-current acceleration of electrons. An extensive bibliography is included. Author

N69-27393# Brookhaven National Lab., Upton, N.Y.
LONGITUDINAL INSTABILITIES IN SYNCHROTRONS AT TRANSITION
Robert L. Pease 18 Dec. 1968 18 p refs
(BNL-13266) Avail: CFSTI

In a previous investigation of longitudinal instabilities at transition, the analysis was carried out using solutions which did not hold at transition. This analysis is modified by using the much more accurate fractional-order Bessel function solutions of Courant and Snyder. For the AGS, under conditions which might lead to instability, the difference in predicted instability behavior appears to be negligible, and the cruder theory suffices for this purpose. Author (NSA)

N69-26827# Naval Research Lab, Washington, D C
REPORT ON LINAC OPERATION Interim Report, 1 Jul.–31 Dec. 1968
T. F Godlove Jan. 1969 27 p refs
(AD-683657; NRL-MR-1960; IR-7) Avail: CFSTI CSCL 20/7

The operation and use of the NRL 60 meV Electron Linear Accelerator is described for the period 1 July–31 December 1968. Progress on the Linac Branch research program is discussed, including results of electron scattering on S-D shell nuclei, progress on two 16 O photonuclear experiments, and studies of thermal neutron capture on YB isotopes The time-of-flight facility, used for resonance neutron capture experiments, is operational and preliminary results on capture by 170 YB have been obtained. A newly-installed gas target chamber for the electron scattering facility has enabled new data on 20 NE to be taken. Author (TAB)

N69-27466*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEVICE FOR HANDLING HEAVY LOADS
Robert J. McCann, inventor (to NASA) Issued 4 Mar. 1969 (Filed 9 Nov. 1966) 5 p Cl. 248–317
(NASA-Case-XNP-4969; US-Patent-3,430,909; US-Patent-Appl-SN-593604) Avail: US Patent Office CSCL 22D

The distribution of a high concentrated force over a large area of an object is considered where an object is to be raised and has a relatively thin skin that can be easily damaged by a concentrated force. A connection, including a frame and a plurality of resilient pins, is provided between the means applying the force and the object. The pins are supported by their ends by the frame, like simple beams. The central portion of each pin is connected to the object. The concentrated force is applied to the frame. The idea is to transmit the concentrated force through the resilient pins so that each pin bends within its elastic limit when a precalculated load on it is reached. Knowing the force to be applied, the pins can be designed to bend under a precalculated load. That is, as a pin bends, adjacent pins pick up the load to thus distribute the concentrated force over a larger area of the object. Official Gazette of the U.S. Patent Office

N69-27470# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SACLAY ELECTRON LINEAR ACCELERATOR [L'ACCELERATEUR LINEATRE A ELECTRONS DE SACLAY]
H. Leboutet (Compagn. Gen. de Telegraphie Sans Fil, Corbeville) and F. Netter [1968] 35 p refs In FRENCH Presented at the Conf. on Expt. Methods in Nucl. and Particle Phys., Strasbourg, France, 4 Dec. 1968
(CEA-CONF-1229; CONF-681208-8) Avail: AEC Depository Libraries

A detailed description is given of the Saclay electron linear accelerator. The base characteristics and the characteristics imposed on the beam are given. The results of the preliminary tests are reported. The principal subassemblies of the accelerator (the sections, high frequency power sources, stabilization and maintenance of the beam properties, and positron acceleration together with electron-positron converter) are described. Uses of the beam are indicated. NSA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-26175# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF HEAT TRANSFER ON FRONTAL SURFACE OF BLUFF BODY IN HYPERSONIC FLOW
Yu. N. Ermak et al 14 Nov. 1968 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, 1967 p 153–156
(AD-683953; FTD-HT-23-653-68) Avail: CFSTI CSCL 20/4

Viscous hypersonic flow at high Reynolds numbers over a blunt-nosed body is considered on the basis of Navier-Stokes equations. An asymptotic solution of the Navier-Stokes equations is obtained for the case where substantial viscous effects are present in the entire inner layer. A distinctive feature of the boundary value problem considered is that it contains a new similarity parameter. Author (TAB)

N69-26225# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SECONDARY INSTABILITY OF THE BOUNDARY LAYER
L. M. Maseev 10 Jul. 1968 11 p refs Transl. into ENGLISH from Sb. Tr., Inst. Inzh. Zheleznodorozhnogo Transp. (Leningrad), no. 222, 1965 p 64–70
(AD-683085; FTD-HT-23-501-68) Avail: CFSTI CSCL 20/4

The article starts with a statement of the general problem of hydrodynamic instability. The transition from laminar to turbulent flow may be considered from the viewpoint of the development of infinitely small perturbations distributed over the whole field of flow. It was demonstrated and experimentally verified that the boundary layer is unstable with respect to Tomlin-Schlichting perturbations, which are waves propagating downstream along the flow. In the case of neutral perturbations, the amplitude of the carrier wave remains constant. Theory gives a value of approximately 420 for the critical Reynolds number. The article proceeds to set up a system of differential equations describing the problem of the instability of the boundary layer. The solution is carried out by the method of Kantorovich, which involves the reduction of the system of equations in partial derivatives to a system of ordinary differential equations. Author (TAB)

N69-26243# Joint Publications Research Service, Washington, D.C.
CALCULATION OF THE BOUNDARY LAYER AT THE ELECTRODE OF A PLANE MHD GENERATOR
A. Ye. Yakubenko *In its* Soviet Studies on Magnetohydrodynamic Generators 14 May 1969 p 12–21 refs (See N69-26241 14-25)
Avail: CFSTI

The problem of the flow of an electrically conducting gas through crossed electric and magnetic fields in a plane MHD generator with ideally conducting walls is considered. The conditions are set forth for independently solving problems relating to the boundary layer at the electrodes and to the center of the flow. The conditions at the center of the flow are calculated numerically by means of one dimensional theory for subsonic and supersonic velocities. The dependences of the flow characteristics on the load parameter are found. The nonautomodel boundary layer equations are solved numerically for small magnetic Reynolds numbers at one of the MHD generator electrodes. The dependence of the resistive force and the Nusselt number on the load parameter and the coordinate along the electrode is found. It is shown that the resistive force and the heat flux described by the Nusselt number increase considerably as compared to the case of nonconducting gas. Author

N69-26277# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHOD OF DESIGNING SUPERSONIC NOZZLES TAKING ACCOUNT OF THE INFLUENCE OF VISCOSITY
V. V. Mikhailov 1969 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1969 p 69–72
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Viscous gas flows in plane or axisymmetric supersonic nozzles are considered. Modes are investigated at which the boundary layer thickness is commensurate with the transverse nozzle dimensions. The inverse problem is solved for the case of such flows; the nozzle shape is computed which will assure conservation of the same flow field in the inviscid core of the flow as exists in a nozzle of known shape intended for an inviscid gas. Boundary layer equations of second order accuracy are used in the computations; slip of the flow and the jump in temperature on the nozzle wall are taken into account. The domain of applicability of the classical boundary layer equations to the problem under consideration is determined by verification of satisfaction of similarity in Reynolds numbers. Author

N69-26292# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXAMPLES OF TRANSONIC IDEAL GAS FLOWS WITH A COMPRESSION SHOCK
G. D. Sevost'ianov 1969 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1969 p 49–52
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Plane irrotational steady ideal gas flows as described by the Karman–Fal'kovich system, are considered with regard to a new class of possible solutions for the transonic equations. The solutions obtained are used to investigate gas flows containing a weak compression shock: (1) a curvilinear shock terminating on the free boundary of a plane sonic jet flowing around a wall with a break in the boundary, and (2) a normal infinite shock on a profile in a sonic stream. Author

N69-26293# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE NUMERICAL COMPUTATION OF STATIONARY VISCOUS INCOMPRESSIBLE FLUID PROBLEMS
K. B. Dzhakupov et al 1969 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR Mekh. Zhidk. Gaza (Moscow), no. 1, 1969 p 95–99
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The disadvantages of utilizing stream functions to compute the two dimensional flows of a viscous incompressible fluid are noted, with regard to the reduced accuracy involved in determining the velocity field by numerical differentiation. A method which avoids these disadvantages is presented for studying a stationary viscous fluid flow, with an implicit finite difference scheme proposed for the numerical solution of the system of equations obtained. Numerical experiments conducted for flows in a square with holes symmetric relative to the axes indicate the stability of the solution. P.A.B.

N69-26326*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
PRESSURE FLUCTUATIONS DUE TO THIN TURBULENT SHEAR LAYERS
A. R. Wenzel Aug. 1968 54 p refs
(Contracts NAS8-21026; NAS8-21100)
(NASA-CR-98435; Rept-68-16) Avail: CFSTI CSCL 20D

Integral formulas are derived for the pressure correlation and mean square fluctuating pressure $\langle p^2 \rangle_{TM}$ owing to the interaction of shear layers (i.e., planes of high mean shear separating regions of uniform, but different, mean velocity) with turbulence. Results for a single shear layer, assuming isotropic turbulence, indicate that in the far field (i.e., at distances from the shear layer large in comparison with the correlation length of the turbulence) $\langle p^2 \rangle_{TM}$ decays as the inverse fourth power of distance from the shear layer. Departure from isotropy, for a given mean kinetic energy of the turbulence, decreases the near field value of $\langle p^2 \rangle_{TM}$ but increases the far field value. For the double shear layer it is shown that if the distance between the shear layers is large in comparison with the correlation length of the turbulence, the resulting value of $\langle p^2 \rangle_{TM}$ is a superposition of the effects of the shear layers acting independently. Otherwise, interaction between the shear layers must be considered. These results are used to obtain order-of-magnitude estimates for the mean square wall pressure fluctuations in a turbulent boundary layer. These estimates show reasonably close agreement with other published results. Author

N69-26421# ARO, Inc., Arnold Air Force Station, Tenn.
SIMPLIFIED METHOD FOR SOLVING PROBLEMS INVOLVING CHEMICALLY REACTING ONE-DIMENSIONAL FLOW Final Report, Jan.–Apr. 1967
I. T. Osgerby AEDC Mar. 1969 53 p refs
(Contract F40600-69-C-0001)
(AD-683260; AEDC-TR-68-268) Avail: CFSTI CSCL 21/2

A simplified technique for solving stiff differential equations common to chemically reacting quasi-one-dimensional inviscid nonequilibrium flow analyses is presented. The method is basically that used by Degroat and Abbett with the generalization made to allow for a prescribed area distribution rather than the constant pressure (and hence constant velocity) process assumed by them. In addition, the equations are written for hydrogen/air combustion rather than methane/air. The advantage of the technique is that the chemical kinetic calculations can be solved quickly without loss of accuracy, and thus can be regelated to the status of a subroutine in complicated fluid-dynamic problems. Author (TAB)

N69-26480# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
TWO-DIMENSIONAL VORTEX FLOW IN THE NEIGHBOURHOOD OF A BOUNDARY CONTAINING A CUSP
R. R. Cousins Feb. 1969 13 p refs
(NPL-Ma-75) Copyright. Avail: CFSTI

In this paper two-dimensional potential flow past a cusp-shaped wall is described. A method due to Ringleb is modified to obtain conditions for establishing a standing vortex downstream of the cusp and in this paper stability of such a vortex is considered both for the potential flow and for a viscous flow. A particular shape for the boundary is examined in detail and its application to the design of a duct containing a tangential fan is described. The theory is further developed to include a sink downstream of the cusp. ESRO

N69-26504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVISCID RADIATING SHOCK LAYERS ABOUT SPHERES TRAVELING AT HYPERBOLIC SPEEDS IN AIR
Richard W. Barnwell Washington May 1969 75 p refs
(NASA-TR-R-311) Avail: CFSTI CSCL 20D

Time-dependent finite-difference techniques are used to obtain numerical solutions for the problem of the inviscid flow of radiating equilibrium air past spheres traveling at hyperbolic speeds. The effects of absorption are included, and results are presented for both gray and nongray absorption coefficient models for spheres with different radii. It is shown that the nondimensional heat-flux distributions for the gray and nongray models are similar and that these distributions are weak functions of the radius of the sphere and the altitude and strong functions of the flight velocity. Author

N69-26522 Stanford Univ., Calif.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: EXPERIMENTAL HEAT TRANSFER WITH VARIABLE SUCTION, BLOWING AND SURFACE TEMPERATURE
Darrill Gene Whitten (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-15107

Stanton number variations due to surface blowing and suction were determined for turbulent flow over the X-Reynolds number range from 3×10^5 to 2.2×10^6. The free-stream velocity was held uniform along the plate and ranged from 18 to 43 fps. Main stream and injected fluids were both air, at essentially ambient conditions. The data are believed to be accurate to within 0.0001 Stanton number units for most of the experimental runs. Several variations of the blowing fraction $F \equiv (\rho V)_w/(\rho U_\infty)$, were included in the test series and both constant and step surface temperatures were investigated in each series. Dissert. Abstr.

N69-26534# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOZZLE OPTIMIZATION PROBLEMS [PROBLEMES D'ADAPTATION DE TUYERES]
P. Carriere, M. Sirieix and J. M. Hardy (Soc. Natl. d'Etude et de Construct. de Moteurs d'Aviation, Villaroche, France) *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 24 p refs In FRENCH; ENGLISH summary (See N69-26526 14-28)
Avail: CFSTI

The optimization of a nozzle is the result of a compromise between various constraints; this leads to discussing the interaction conditions between the internal and external flows downstream of the engine maximum cross-section. For supersonic cruising flight ($M \leq 4$), the various computing methods of the convergent divergent or central body nozzle and afterbody optimum shapes are reviewed. The problems to be solved concern: (1) the eventual evacuation of secondary flows (ventilation, boundary layer bleeds); and (2) the confluence of the internal and external flows. The influence of the various optimization factors (nozzle outlet cross-section, boattail shape, etc.) is discussed. In the case of subsonic or transonic cruising flight, the theoretical solution of the confluence problem is far from being as advanced as in the supersonic case. The problem at the off-design flight of a supersonic aircraft is discussed. Finally, the constraints imposed by the problems of thrust reversal and of the silencer are surveyed. Author

N69-26537# Advisory Group for Aerospace Research and Development, Paris (France).
A CONTRIBUTION TO THE TURBULENT MIXING OF TWO PARALLEL STREAMS INSIDE A MIXING CHAMBER
A. Homburg *In its* Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 14 p refs (See N69-26526 14-28)
Avail: CFSTI

In order to account for the two dimensional effects and to analyze the mixing process at different downstream positions of a mixing chamber with constant diameter, integral relations for the equations of motion are used similar to the method applied to the problem of the turbulent mixing of unbounded coaxial streams. The mixing field is divided into three characteristic zones, in each of which the equations of motion can be integrated when using plausible velocity and density distributions for each cross of the mixing chamber. The results of the calculations for incompressible and compressible flow of streams with equal total enthalpy at the mixing chamber entry are presented and compared with experimental data. Author

N69-26575# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL INVESTIGATION OF TURBULENT STEP-INDUCED BOUNDARY-LAYER SEPARATION AT MACH NUMBERS 2.5, 3, AND 4 Final Report, 29 Apr.–25 Sep. 1968
Jerry S. Hahn AEDC Mar. 1969 40 p refs
(Contract F40600-69-C-0001)
(AD-683767; AEDC-TR-69-1) Avail: CFSTI CSCL 20/4

An experimental investigation of turbulent separated boundary-layer flow was conducted using high forward-facing steps (with side plates) mounted on a flat plate at zero angle of attack. The tests were made at Mach numbers of 2.5, 3.0, and 4.0 for Reynolds numbers, based on the boundary-layer total thickness at the separation location, from 100,000 to 150,000. The effects of Mach number, step height and span, end plates, and step-face fairings were investigated. Data are presented graphically and in tabulations and include model surface pressures on the flat plate and on the face and top of selected steps, boundary-layer Mach number profiles, and selected oil dot photographs. Author (TAB)

N69-26599 Michigan State Univ., East Lansing.
A STUDY ON FLOW THROUGH POROUS MEDIUM
Hon-Hsieh Su (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-17140

The present investigation is a probabilistic study of the porous medium and the mechanism of fluid flow in the pore system. If the porous medium is such that its pores have different orientation with respect to certain direction and the hydraulic gradient is the sole cause for the fluid particle to move in the pores, then the tortuous paths of the pores will result in a dispersion of fluid flow in a porous medium. A canal network model of a porous medium was assumed in this study. An orientation factor was used to represent the preferred orientation of the pore canals. For given canal distributions, it was possible to calculate the degree of dispersion at a given time. A theoretical analysis of dispersion was made based on the assumption that a fluid particle would travel in a pore canal network system by following the probability distribution function for the choice of direction. Dissert. Abstr.

N69-26617 Iowa Univ., Iowa City.
AN ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND STATISTICAL MEASURES OF BED CONFIGURATIONS IN STRAIGHT AND CURVED ALLUVIAL CHANNELS
David Squarer (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-16862

The reliability of predictors for friction factors and rates of sediment transport in alluvial channels is open to question when they are applied to sinuous channels. Bed-form geometry in a curved channel and a straight flume which are subject to the same nominal flow conditions is investigated by statistical analysis of records of steam bed profiles. Autocorrelation, spectral density and

probability density functions of a process defined by the bed elevation as a function of the distance along the channel, or as a function of elapsed time at a fixed point of the channel are computed by digital computer. Comparison of the statistical descriptors obtained from the curved channel and from the straight flume permits a quantitative evaluation of the marked differences between bed geometry in curved and straight channels. Dissert. Abstr.

N69-26629# Union Carbide Corp., Oak Ridge, Tenn. Gaseous Diffusion Plant.
FLOW AND SELF-DIFFUSION OF GASES IN CAPILLARIES, PART 3
L. M. Lund and A. S. Berman (Minnesota Univ.) 20 Jun. 1968 155 p refs
(Contract W-7405-ENG-26)
(K-1739-Pt-3) Avail: CFSTI

The detailed data involved in the model and data interpretation presented in Parts I and II are presented in 94 tables. Details of the equipment and experimental technique including the theory and practice of the primary measurements are included. Author (NSA)

N69-26656# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
IMPULSIVE MOTION OF A FLAT PLATE WITH A SHARP LEADING EDGE IN FREE-MOLECULAR FLOW
Prem K. Khosla Dec. 1968 21 p refs
(Contract Nonr-839(34))
(AD-683674; PIBAL-68-38) Avail: CFSTI CSCL 20/4

Impulsive motion of a semi-infinite and finite flat plate in free-molecular flow is examined. The collisionless Boltzmann equation for the problem is solved such that the effect of gas-surface interaction could be incorporated. For diffuse reflexion the solution does not show any discontinuous behavior found in the continuum or near continuum limits. Author (TAB)

N69-26667 Michigan State Univ., East Lansing.
APPLICATIONS OF HYDRODYNAMIC THEORY TO MULTICOMPONENT LIQUID DIFFUSION
Terence Kenneth Kett (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-17102

Hydrodynamic theory is applied to multicomponent diffusion of non-electrolytes. Generalized equations are derived for the flows, diffusion coefficients, and the phenomenological coefficients for non-associating systems. Similar equations are derived for associating systems but only for the simplest ternary cases where either one component associates with itself to form dimers or where two components associate with each other to form dimers. The theory indicates that under the condition of constant partial molar volumes, Onsager's reciprocal relations are valid for non-associating systems and for the associating systems with the additional assumption that the partial molar volume of the associated species is equal to the sum of the partial molar volumes of the species making up the dimer. Dissert. Abstr.

N69-26684*# Southwest Research Inst., San Antonio, Tex.
SLOSH FORCE, NATURAL FREQUENCY, AND DAMPING OF LOW-GRAVITY SLOSHING IN OBLATE ELLIPSOIDAL TANKS
Franklin T. Dodge and Luis R. Garza Feb. 1969 31 p refs
(Contract NAS8-20290; SwRI Proj. 02-1846)
(NASA-CR-98443; TR-7) Avail: CFSTI CSCL 20D

Liquid sloshing in oblate ellipsoidal tanks is studied experimentally under conditions of simulated low gravities. The results demonstrate that the variation of free-surface curvature with liquid depth has a strong influence on the natural frequency; for tanks over one-half full, the frequency decreases markedly as the Bond number is decreased. Moreover, the force response characteristics show that the mass of liquid participating in the sloshing is, in every case, less than the corresponding sloshing mass for a flat free surface. Calculations of the slosh damping show it to be a function of the liquid level, the Bond number, and the Galileo number. Author

N69-26709 Cornell Univ., Ithaca, N.Y.
DIFFUSION OF HEAT AND VORTICITY FROM A SEMI-INFINITE PLATE IN A FINITE SHEAR FLOW USING AN OSEEN-LIKE MODEL
Werner Koch (Ph.D. Thesis) 1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-15726

The diffusion of vorticity in a rotational stream is of importance in the boundary layer calculation for bodies placed in a supersonic or hypersonic flow, where the shock curvature introduces vorticity into the inviscid stream behind the shock. In studying unbounded uniform shear flow over a semi-infinite plate T. Li (1956) discovered an induced pressure gradient along the plate, the existence of which was disputed by M. B. Glauert (1957). Because no unbounded shear flows exist in nature, and we are not certain how to interpret such flows, we have investigated shear flow over a semi-infinite plate bounded in the lateral direction by two moving walls. This boundary value problem is formulated for an Oseen-like model of the Navier–Stokes equations, i.e., we replace the convection velocity by a uniform shear velocity. The fact that we have semi-infinite boundaries allows us to formulate the problem in a way that is amenable to exact solution by the Wiener-Hopf technique. Dissert. Abstr.

N69-26719*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
LIQUID-GAS INTERFACE CONFIGURATIONS IN INTERCONNECTED CONCENTRIC CYLINDER TANKAGE SYSTEMS
Frederick W. Geiger and James C. May Sep. 1967 54 p refs
(Contract NAS8-20073)
(NASA-CR-101107; R-244) Avail: CFSTI CSCL 20D

A computer program was developed to graphically and analytically define the static shape of the liquid–gas interface in the annular region between any two concentric cylinders in an axial force field for any Bond number and contact angle. The program also includes as a subroutine a previously reported method of calculating the static shape of the liquid–vapor interface within a single cylindrical tank. Static fluid surface coordinates for both the annular and central regions are given for Bond numbers (with inner cylinder radius as characteristic length) ranging from 10 to 500, for a contact angle of 5 degrees, and for a radius of 1.5. Author

N69-26729 Iowa Univ., Iowa City.
HEAT TRANSFER IN VISCOUS LAMINAR FLOW THROUGH A RECTANGULAR DUCT
Sung Whee Hong (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16816

In order to observe the temperature effect on viscosity, ethylene glycol was chosen. For a fully developed viscous laminar flow, the temperature effect on viscosity influenced the velocity and the temperature profiles because near the wall of the duct, the temperatures were lower than the average temperature which gave the higher viscosities, and near the center, the opposite phenomenon happened. For an undeveloped laminar flow, the thermal boundary layer theory was applied to compute the developed layer

thicknesses. The experimental data proved that the numerical solution with variable viscosity agreed with that of a viscous fluid. The Nusselt numbers for the system of variable viscosity were 15 to 20% larger than those with constant viscosity, and 5 to 7% larger than those by the approximate and analytical solution. These results are significant in the design of heat exchangers. The temperatures, the pressure drops, and flow rates were measured after the steady state was established. Dissert. Abstr.

N69-26734 Institute of Paper Chemistry, Appleton, Wis.
TURBULENT TUBE FLOW OF DILUTE FIBER SUSPENSIONS
Truman Leo Seely (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-18131

In an effort to identify the time-average characteristics of turbulent fiber suspension flow, experiments were designed and carried out to determine velocity profiles and pressure drops in the flow of suspensions through tubes. Additional experiments were performed to measure the response of a coherent fiber network to hydrodynamic stresses and to examine relative motion between a wall and a network-forming suspension. Turbulent tube flow of dilute fiber suspensions (0.05 to 0.50 g./100 ml.) is divided into three regions on the basis of pressure drop-flow rate correlations and velocity profiles. These regions are designated plug turbulence, damped turbulence, and Newtonian turbulence. Some evidence is presented to suggest the presence of a coherent fiber network forming a central plug during plug turbulence. The central plug shrinks as flow rate increases, finally disappearing as the damped turbulence regime is entered. It is proposed that the plug boundary position is determined by the shear stress within the tube. Dissert. Abstr.

N69-26747# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE NEAR WAKE IN AN AXISYMMETRIC SUPERSONIC FLOW WITH AND WITHOUT BASE INJECTION Final Report, 27 Jun. 1964–26 Jun. 1968
Ram Sinha and Victor Zakkay May 1968 70 p refs
(Contract DA-31-124-ARO(D)-259)
(AD-683528; NYU-AA-68-26) Avail: CFSTI CSCL 20/4

Results of an experimental and theoretical investigation of the near wake in an axisymmetric flow past a slender body at Mach number 3.92 with and without base injection are presented. For the experimental part centerline distributions of pressure, temperature, Mach number, velocity, and concentration were obtained. Turbulent as well as laminar flow fields were investigated for the zero injection case. Base injection problem was studied only in the turbulent flow case using gaseous hydrogen, halium, nitrogen, and argon as injectants. A special effort was made to study the variation of pressure, velocity, and Mach number at the base with base injection. For the theoretical part an expression was developed to calculate the centerline distribution of turbulent viscosity from experimental profiles using full Navier-Stokes equations; flow fields with non-zero pressure gradients were considered. Using this expression, centerline viscosity distributions for various cases of wake flow and coaxial mixing were calculated and the results compared with those obtained from the empirical models. Author (TAB)

N69-26832# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ON INITIAL CONDITIONS FOR VISCOUS INTERACTING FLOWS Final Report
Wilbur L. Hankey and Howard E. Bethel Dec. 1968 21 p refs
(AD-683727; ARL-68-0216) Avail: CFSTI CSCL 20/4

The system of equations for solving supersonic viscous (boundary layer) interacting flows is examined for the case of weak interaction. Present methods employ Blasius flat plate flow as initial conditions and permit the flow to evolve from that point. The work shows that this case exhibits a saddle point singularity in that either highly retarded or highly accelerated flows evolve. These findings then cast doubt on the present day formulation of such problems and suggest that more complete terms from the Navier-Stokes equations be employed rather than the simplified boundary-layer equations. Author (TAB)

N69-26844# Royal Aircraft Establishment, Farnborough (England).
TIP LOSSES IN LINEAR CASCADES OF BLADES. [DIE RANDVERLUSTE IN GERADEN SCHAUFELGITTERN]
H. Wolf Dec. 1968 32 p refs Transl. into ENGLISH from Wiss. Z. Tech. Hochschule (Dresden), v. 10, no. 2, 1961
(RAE-Lib-Trans-1336) Avail: CFSTI

This paper deals with the problem of secondary flow loss in cascades of blades by discussing the extensive experimental investigations carried out on linear cascades in a wind tunnel. It is shown that, for incompressible flow, the tip loss can be represented as a function of a small number of cascade parameters. Author

N69-26863 Idaho Univ., Moscow.
A STATIONARY BUBBLE TECHNIQUE FOR STUDYING MASS TRANSFER FROM GAS TO FLOWING LIQUID
Allen Dale Kartchner (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16993

Mass transfer between gas bubbles and a liquid was developed as a means of obtaining more knowledge of the transfer process. A gas bubble was maintained in a stationary, nonvibrating condition by allowing the bubble to seek the position in a vertical tapered tube where the upward buoyant force was balanced by the downward drag force created by the downward flow of a liquid. It was possible to maintain the bubble stationary even as the bubble diminished in size due to mass transfer from the bubble to the liquid. The stationary bubble technique has several advantages not obtainable with other gas bubble-liquid techniques. It is possible to study transfer under dynamic conditions for extended periods of time; for example, oxygen bubbles in water were studied for over five minutes. The technique is especially suited to relatively insoluble gas-liquid systems and permits the bubble to remain at constant pressure and temperature. Dissert. Abstr.

N69-26877 Idaho Univ., Moscow
THE EFFECT OF SECONDARY FLOW ON POINT HEAT TRANSFER COEFFICIENTS FOR TURBULENT FLOW INSIDE CURVED TUBES
George William Hogg (Ph.D. Thesis) 1968 239 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-16990

The present work includes obtaining well-developed velocity and temperature profiles for air flowing in a curved tube at Reynolds numbers ranging from 2,000 to 135,000. A probe to measure peripheral velocity components was developed to allow quantitative determination of the secondary flow. The profiles indicated a very different flow pattern than realized in straight pipe, and the generation of a secondary flow was quite obvious. The profiles provided the necessary data to calculate point shear stresses, point friction factors, and point heat transfer coefficients. The Prandtl heat transfer analogy as applied to flow in curved tubes was tested and found to represent the data very well if correctly applied. Heat transfer coefficients, based on velocities and temperatures at the edge of the respective boundary layers, as calculated from the Prandtl analogy agreed within 25% with experimentally measured values in the entire turbulent flow Reynolds number range investigated. Dissert. Abstr.

N69-26904 Cornell Univ., Ithaca, N.Y.
THE EFFECT OF THE COULOMBIC POTENTIAL ON THE VISCOSITY OF A FLUID
Reginald Graham Morrison, Jr. (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-16188

By assuming that a salt and a fluid like the salt in every way except for the Coulombic interaction have identical pair distribution functions, one would conclude from the Kirkwood theory for transport properties that at the same temperature and particle density, their viscosities would be almost identical. The pair distribution function, however, may be changed by the imposition of the Coulombic field. This difference allows the possibility for the salt and its analogue to have very different viscosities. The criteria for choosing substances for a comparison are given. When compared at the same temperature and particle density, the ratio of the salt viscosity to the viscosity of its analogue is no less than 4.5 and diverges as the temperature decreases or density increases. A calculation of the ratio of the salt viscosity to that of its non-ionic analogue, using a reasonable intermolecular potential and a suitably normalized pair distribution function which is an attempt to account for the shift in the distribution due to the Coulombic potential, yields a ratio of 2.3. Dissert. Abstr.

N69-26944 Cornell Univ., Ithaca, N.Y.
THE RHEOLOGY OF HIGH MOLECULAR WEIGHT SILICONES
Steven Michael Fruh (Ph.D. Thesis) 1968 215 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-16742

The basic idea of this thesis was to study the viscosity and elasticity of high molecular weight bulk polymers with a simple, basic piece of apparatus, which would require a minimum amount of data interpretation. The design selected for the new viscometer was that of a parallel plate viscometer, based on air bearings and a Linear Variable Differential Transformer. The equipment is essentially frictionless. A sample of known dimensions is placed between the plates and distorted, in shear, by a known shear stress. A strain-time curve is produced. When the shearing force is removed, the elastic recovery versus time curve is drawn. The samples studied were linear polydimethylsiloxanes, ranging in molecular weight from 220,000 to 1,780,000. The various molecular weight fractions were obtained from one sample by the fractionation technique of successive precipitation from solution, with the toluene-methanol system being used here. The fractions were characterized for molecular weight by gel permeation chromatography. Dissert. Abstr.

N69-26964 Delaware Univ., Newark.
AN ENGINEERING EVALUATION OF VISCOELASTIC CONSTITUTIVE EQUATIONS
Robert Ford Ginn (Ph.D. Thesis) 1968 187 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-17846

Steady state shear stress and two normal stress combinations were determined for 6-1/2, 8-1/2, and 10-1/2 weight per cent polyisobutylene in decalin, for simple shear flow, using a Weissenberg rheogoniometer. With the cone and plate, total force, technique, the shear stress, τ, and the first normal stress difference, $P_{11}-P_{22}$, were determined. With the parallel plates, total force, technique, the shear stress and the normal stress $-3P_{22}$ were determined. The second normal stress difference was determined by combining the two experimentally determined normal stresses: $(P_{22}-P_{33}) = (P_{11}-P_{22}) - (-P_{22})$. All of the equations considered were used to predict the behavior of 10-1/2% polyisobutylene in stretch flow and pure shear flow. It was determined that the equations predicted stretch and pure shear viscosities of radically different type, one of which predicted infinite viscosities at finite shear rates and the other finite viscosities, generally decreasing with increased shear rate. Dissert. Abstr.

N69-26955*# Virginia Univ., Charlottesville. Div. of Aerospace Engineering and Engineering Physics.
DRAG COEFFICIENTS FOR SPHERES FOR FREE MOLECULAR FLOW IN NITROGEN AT SATELLITE VELOCITIES
John W. Boring and Robert R. Humphris Feb. 1969 36 p refs
(Contract NAS1-2538)
(NASA-CR-66785; EP-4018-159-69U) Avail: CFSTI CSCL 20D

Laboratory measurements have been made of the momentum transfer by a beam of N_2 molecules to surfaces in the molecular energy range 8–200 eV. The measurements have been performed as a function of angle of incidence for samples of the surfaces of Echo 1, Echo 2, and Explorer 19 satellites. The results have been used to calculate drag coefficients for spherical bodies, yielding $1.9 < C_D < 2.2$. Author

N69-26956*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPLORATORY INVESTIGATION ON THE MEASUREMENT OF SKIN FRICTION BY MEANS OF LIQUID CRYSTALS
Enrique J. Klein and Angelo P. Margozzi Washington May 1969 12 p refs
(NASA-TM-X-1774) Avail: CFSTI CSCL 20D

A new method is proposed for directly measuring local skin friction in aerodynamic testing. It makes use of thin coatings of cholesteric liquid crystal mixtures that respond to shearing forces by changes in the wavelength of maximum light scattering. A calibration of shear versus wavelength was obtained for a sample substance; a static calibration was made to measure the effects of temperature, pressure, and angle of viewing; and the behavior of the substance was observed in a pipe-flow experiment. Preliminary results showed that the method appears feasible. Author

N69-26974 Wisconsin Univ., Madison.
TIME-DEPENDENT NONLINEAR BEHAVIOR OF VISCOELASTIC FLUIDS
Ian Francis Macdonald (Ph.D. Thesis) 1968 840 p
Avail: Univ. Microfilms: HC $28.80/Microfilm $8.10 Order No. 68-13648

A Weissenberg Rheogoniometer was used to determine: (1) complex viscosity for steady shear flow with superposed parallel "small amplitude" oscillatory shear; (2) complex viscosity for "larger amplitude" oscillatory shear; (3) shear and normal stress relaxation functions after cessation of steady shear flow; and (4) shear and normal stress growth functions on onset of steady shear flow for polymer solutions. The fluids investigated were eleven solutions of monodisperse polystyrene in Aroclor. In addition, a 2.0% (by weight) polydisperse polyisobutylene in Primol and a 1.5% (by weight) polydisperse polyacrylamide in a 50/50% (by weight) mixture of water and glycerine were studied. Two constitutive equations, the Bird-Carreau model and the modified OWFS model, whose constants had been determined by fitting the previously determined data, were evaluated by their ability to fit the data presented here. Dissert. Abstr.

N69-26987*# National Aeronautics and Space Administration, Washington, D.C.
COMPRESSED GAS HANDBOOK
John S. Kunkle, ed., Samuel D. Wilson, ed., and Richard A. Cota, ed. 1969 572 p
(NASA-SP-3045) Avail: SOD $4.75; CFSTI CSCL 20D

A complete source of the theory and data required to analyze high pressure compressible flow systems found in space vehicle ground support equipment is provided. The theoretical equations of fluid flow by derivation are developed. Practical problem solving is treated qualitatively. In the section on applications, the theory is presented without the supporting derivations and treats practical

problems quantitatively. It is intended as a ready reference for analysis. A feature is the full size working charts for the rapid solution of common compressible flow problems. A selection of basic thermodynamic data for air, nitrogen, oxygen, helium, and hydrogen is appended. The data range is as wide as possible for completeness, and special emphasis is given to data up to 6000 psig, and from +150°F to −100°F. Author

N69-26988 Lehigh Univ., Bethlehem, Pa.
FLOW IN A TWO DIMENSIONAL DIFFUSER WITH EXTRACTION OF FLUID ON THE DIVERGING WALLS
Donald Orlando Rockwell, Jr. (Ph.D. Thesis) 1968 189 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-15918

The flow in a two-dimensional diffuser with distributed extraction through the diverging walls is investigated analytically and experimentally. Formulation of the mathematical model requires that a homogeneous boundary value problem, in which the amount of fluid extracted is represented by the magnitude of the normal derivative over a prescribed distance along the boundary, be solved. Potential solutions which give velocities, and consequently pressures, throughout the flow field were obtained using two different mathematical techniques. One technique enables prescription of an arbitrary distribution of extraction velocity along the diverging wall, and the other technique gives a theoretical expression for streamlines of the flow field for the case of a constant distribution of extraction velocity. Dissert. Abstr.

N69-26991# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
EXPERIMENTS ON THE FLOW PROCESSES IN SIMPLE ROTATING CHANNELS
H. S. Fowler Jan. 1969 81 p refs
(NRC-10667; ME-229) Avail: CFSTI

To make a more detailed study of the character and distribution of flow in channels, a new series of tests was carried out and is described. The complete rotor was replaced by simplified models of single channels, in which the flow was compared while the channel was stationary, or rotating. These two-dimensional channels were given a range of divergence angles, and the flow compared with that in stationary diffusers. It was shown that rotation stabilized the flow pattern, with breakaway from the wall occurring on the suction side of the rotating channel, and a jet of high-speed flow issuing from the pressure side of the channel. Channel-exit speed and stability profiles are presented covering ranges of channel divergence angles, and Reynolds and Rotation Numbers. Smoke visualization pictures enable the flow within and downstream of the channel to be seen, and show the location of the flow detachment point on the suction wall. Author

N69-26998# Pennsylvania State Univ., University Park. Ordnance Research Lab.
LAMINAR BOUNDARY LAYERS ON BODIES OF REVOLUTION: COMPUTER PROGRAMS AND VORTICITY BUDGETS
R. E. Sheridan, Jr. 26 Jul. 1968 68 p refs
(Contract NOw-65-0123)
(AD-683787; TM-502.2421-19) Avail: CFSTI CSCL 20/4

The incompressible laminar boundary layer equations are solved for flow about a sphere and an ellipsoid using a finite difference scheme. The effects of vortex stretching on the momentum and vorticity equations are studied. Author (TAB)

N69-27010# California Univ., Berkeley. Div. of Aeronautical Sciences.
AN EXACT INTEGRAL EQUATION FOR STEADY SURFACE WAVES
John Byatt-Smith Feb. 1969 28 p refs
(Contract Nonr-222(79))
(AD-683707; AS-69-3) Avail: CFSTI CSCL 20/4

An exact integral equation is found for inviscid steady surface waves. Existing known approximations are all derived from the one equation. A numerical solution is attempted in the case of the solitary wave. From the numerical solution the amplitude of the solitary wave of maximum height is estimated. The numerical solution is also compared with the existing approximations and the implications drawn from the comparison are discussed. Author (TAB)

N69-27060*# Purdue Univ., Lafayette, Ind. Heat Transfer Lab.
IMPROVED FLUID DYNAMICS SIMILARITY, ANALYSIS AND VERIFICATION. PART 2: EFFECTS OF LONGITUDINAL VIBRATION ON DISCHARGE OF LIQUIDS FROM PROPELLANT TANKS Final Report, 29 Jun. 1966–28 Jun. 1968
E. R. F. Winter, R. J. Schoenhals, R. W. Grieba, E. I. Griggs, H. Y. Pak et al Oct. 1968 158 p refs
(Contract NAS8-20222)
(NASA-CR-98442) Avail: CFSTI CSCL 20D

A study of liquid discharge from a cylindrical container exposed to longitudinal vibration is described. The experimental results presented reveal the existence of a flow retardation effect due to vibration. The magnitude of this retardation increases with vibrational acceleration level and decreases with both the vibration frequency and with the outlet tube length. Photographs showing some of the more interesting visual observations are given. Possible causes of the flow retardation effects are discussed. These are based on analytically derived results and on evidence provided by the photographs. Author

N69-27069# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIDIMENSIONAL NONSTATIONARY REAL GAS FLOW
V. A. Eroshin et al 2 Jul. 1968 14 p refs Transl. into ENGLISH from Sb. Rabot. Vychislitelnyy Tsentr. Moscow Univ. (Moscow), no. 4, 1965 p 221–231
(AD-683154; FTD-HT-23-420-68) Avail: CFSTI CSCL 20/4

The attainment of high projection velocities of ballistic projectiles is connected with the generation of flow zones of high-temperature (2000-6000K) and high-pressure (5000-10,000 atm) gases. Under such circumstances the gas differs markedly from the ideal case because of dissociation, ionization, and mixture component interaction. The present paper investigates the influence of equilibrium dissociation on the real gas flow through tubes, using air as the example. The related thermodynamic functions depend on temperature and pressure, and the paper utilizes pertinent data as found in tables compiled after approximating them by polynomials. The dissociation influence calculations are carried out using the method of characteristics of the real gas flow through cylindrical tubes. Author (TAB)

N69-27073# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYMPTOTIC SOLUTIONS OF NAVIER-STOKES EQUATIONS IN REGIONS WITH LARGE LOCAL PERTURBATIONS
V. Ya. Neiland et al 18 Nov. 1968 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk USSR, Mekh. Zhidk. Gaza (Moscow), no. 4, 1966 p 43–49
(AD-684012; FTD-HT-23-339-68) Avail: CFSTI CSCL 20/4

A theoretical treatment of the problems of supersonic flows with local flow singularities such as flows near corner points, in the region of boundary layer-shock wave interaction, near points of separation or reattachment of flow, etc., is presented on the

basis of the general analysis of the asymptotic behavior of solutions of the Navier-Stokes equations. A known method of constructing and matching asymptotic expansions representing solutions in different characteristic flow regions with infinitely decreasing viscosity is used here. As an illustrative example, the problem of viscous supersonic flow near a surface with a large local curvature is treated in detail. It is assumed that the free flow is uniform and supersonic. Distributions of friction stress, heat fluxes, and pressure in different regions of the surface are analyzed and the possibility of the formation of a local zone of separation is discussed. TAB

N69-27086 Johns Hopkins Univ., Baltimore, Md.
FLOW DEVELOPMENT IN LIQUID FILMS
Lawrence Heisler Weiss (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-16496

The development of the flow field in the entrance region of a thin liquid film is analyzed. Retention of the inertia terms in the Navier–Stokes equations for steady, incompressible flow allows evaluation of the effects of the liquid acceleration caused by the gravitational force. The analysis leads to a model that is similar to that for a boundary layer with the same type of simplifications based on order-of-magnitude arguments. A similarity transformation then reduces the equation of motion to an ordinary differential equation and properly transforms the boundary conditions. The location of the edge of the film is a function of downstream position, while the flow is developing. Since the outer boundary condition is evaluated at the free surface, the usual boundary layer calculation procedures are modified to allow variation in the location of the outer boundary. Dissert. Abstr.

N69-27106# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERSONIC GAS FLOWS IN PERFORATED BOUNDARIES
G. L. Grodzovskii et al 4 Mar. 1968 137 p refs Transl. into ENGLISH of the book "Sverkhzvukovye Techeniya Gaza v Perforirovannykh Granitsakh" Moscow, Izd. Mashinostr., 1967 p 1–144
(AD-684011; FTD-HT-23-1519-67) Avail: CFSTI CSCL 20/4

The book presents the results of the numerous research works performed by the authors in the period 1949-51 on the effect of perforated boundaries on supersonic-flow structures. In particular, it presents the results of theoretical and experimental investigations of new general properties of supersonic-gas flows in perforated boundaries. Methods of regulating the M number in rigid nozzles, straightening of supersonic flows, and increasing of permissible test model sizes in supersonic wind tunnels are described. Author (TAB)

N69-27124 Polytechnic Inst. of Brooklyn, N.Y.
A TWO-PARAMETER INTEGRAL METHOD FOR LAMINAR BOUNDARY LAYERS WITH MASS TRANSFER
James Bentson (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-16234

It is found that for problems involving suction, the fourth-degree profile is not adequate to represent the asymptotic suction velocity profile, which is the limiting solution for flow involving suction. It is shown that where the fifth-degree profiles are used, a technique involving an analytic expansion of the pertinent variables about the singularity at the leading edge, coupled with a numerical integration to continue the solution, is straightforward, accurate and applicable to a wide variety of problems involving mass transfer and pressure gradient. To illustrate the validity of the proposed technique, the latter is first applied to the asymptotic suction problem. The problem of a flat plate with impermeable wall, a similarity distribution of suction and injection and homogeneous suction is then considered. The case of a linearly retarded external velocity over an impermeable wall is treated. Dissert. Abstr.

N69-27125 California Univ., Los Angeles.
UNSTEADY ROTATIONAL STAGNATION-POINT FLOW WITH HEAT TRANSFER
Alan Sherwin Hersh (Ph.D. Thesis) 1968 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-16537

Solutions describing the inviscid behavior of the fluid show that the vorticity components parallel to the wall are strongly amplified by vortex stretching. It is the behavior of the lateral vorticity components when the fluid is viscous that is of interest here. To study the relationship between the inviscid vortex stretching tending to amplify and concentrate the lateral vorticity components and its subsequent diffusion near the wall, the Navier–Stokes equations of motion were solved in an approximate wave. The steady-state solutions are generalized to allow the lateral vorticity to be time-dependent. A lowest-order analysis shows that the frictional hearing becomes significant only if the magnitude of the lateral vorticity is large compared to the basic velocity gradient of the normal flow and if the vehicle shape is almost two-dimensional. Dissert. Abstr.

N69-27141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE AERODYNAMIC HEATING OF LIFTING BODIES
G. I. Maikapar 21 Nov. 1968 16 p refs Transl. into ENGLISH from Congr. of the Intern. Astron. Federation 19th. (New York), 1968 p 1–14
(AD-684021; FTD-HT-23-1101-68) Avail: CFSTI CSCL 20/4

Singularities in the heat flow distribution over the surface of the vehicles, using the aerodynamic lift, are considered. Maxima of the heat flow, may appear on the lower vehicles surface (attached flow) as the consequence of the large curvature of the edges and on the upper surface in the case of detached flow. Results of the laminar boundary layer calculations and of the experiments in supersonic tunnels are given. Author (TAB)

N69-27154# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSITION AND COMPRESSOR SYSTEMS OF A CENTRIPETAL-FLOW TURBINE
Yu. I. Freyman 1 Aug. 1968 14 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 10, 1965 p 37–39
(AD-683215; FTD-HT-23-470-68) Avail: CFSTI CSCL 21/5

Operation of a centripetal turbine in the transition and compressor regimes during sharp decreases of flow rate through the turbine is discussed, and experimental characteristics of a turbine operating in these regimes are presented. An approximate equation is derived to find the conditions of sudden transition from turbine to compressor operation. Experimental characteristics in the turbine-compressor transition regions for a centripetal turbine are presented graphically, and the locations of the transition jumps are found to be adequately represented by the derived equation. Transition back to the turbine regime occurs at a different point, thus forming a hysteresis loop for the transition processes. Graphs of the internal power of the turbine show that it absorbs substantial power in the compressor regimes and can thus be used as a brake under these conditions. Increased hysteresis effects are expected for high temperature gas operation (tests were made with compressed air). Author (TAB)

N69-27168*# Israel Program for Scientific Translations, Ltd., Jerusalem.
NONLINEAR PROBLEMS OF COMPRESSIBLE FLOW
A. G. Bagdoev 1969 172 p refs Transl. into ENGLISH of the publ. "Nekotorye Nonlineinye Zadachi o Dvizhenii Szhimaemoi Zhidkosti" Erevan, Izd. AN Arm. SSR, 1967 Published for NASA and NSF *Its* Cat. NO. 5436
(NASA-TT-F-560; TT-69-55023) Copyright. Avail: CFSTI CSCL 20D

The motion of a half-space of ideal compressible fluid due to an arbitrary pressure front moving over its surface is considered. Physically, such a situation arises in an explosion on or above the surface of a fluid. Since a liquid is a considerably denser medium than air, the pressure in the air may be considered as in the reflection of a shock wave from a rigid wall. Consequently, the pressure at the liquid surface will be known as a function of the time and coordinates. The problem consists in finding a solution of the gas dynamic equations for given discontinuity conditions at the boundary. For a liquid under pressures of the order of several hundreds of atmospheres, the parameter determining the liquid motion will be small, and a linear theory can be used. The linear theory, however, gives an incorrect picture in the vicinity of the sound wave, as well as near the free surface and at large time. It is also worthwhile to calculate approximations higher than the first. Here the problem is formulated nonlinearly for the pressure, a small parameter is introduced and an isentropic approximation used. It is shown that the linear theory can be greatly improved by using only the linear solution. Various methods of improving the linear solution are studied, and the pressure is determined in the second approximation. Author

N69-27175# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

ON THE USE OF TIME-DEPENDENT METHODS FOR THE SOLUTION OF INVISCID RADIATION PROBLEMS

Ephraim L. Rubin and Prem K. Khosla Nov. 1968 34 p refs

(Contract Nonr-839(34))

(AD-683324; PIBAL-68-33) Avail: CFSTI CSCL 20/4

A solution is presented for the unsteady inviscid hydrodynamical equations for a radiating gas, using a numerical technique which is second-order accurate. The results were satisfactory for weak shocks. For strong shocks it was necessary to calculate the flow in the limit of small viscosity and heat conduction. Author (TAB)

N69-27176# North American Rockwell Corp., Downey, Calif. Space Div.

HYDROELASTIC ANALYSIS OF A CIRCULAR CYLINDER

B. H. Ujihara Dec. 1968 103 p refs

(Contract N00014-68-C-0223)

(AD-683366; SD-68-996) Avail: CFSTI CSCL 20/4

A numerical method of two-dimensional separated flow analysis was previously applied to an immersed circular cylinder at rest. This method, which is based on potential theory, was extended in the study to the case of a flexibly restrained circular cylinder in accelerated motion. Theoretical development of the mathematical model and formulation of the associated computer program are described. Computer results of flow development are presented for an example case of a lightly damped, elastically supported circular cylinder in tune with the Strouhal frequency. Author (TAB)

N69-27196# California Univ., Berkeley. Div. of Aeronautical Sciences.

WAVES ON A THIN FILM OF VISCOUS LIQUID

John Byatt-Smith Feb. 1969 26 p refs

(Contract Nonr-222(79))

(AD-683708; AS-69-4) Avail: CFSTI CSCL 20/4

Consideration is given to the problem of the flow of a viscous incompressible fluid down an inclined wall. A solution is obtained by assuming that the free surface is a wave of low frequency. The solution is numerical and the results are compared with existing theories and available experimental results. Author (TAB)

N69-27228# France. Ministere de l'Air, Paris.

CONTRIBUTION TO THE STUDY OF REVERSE CURRENTS GENERATED BY A CONFINED JET [CONTRIBUTION A L'ETUDE DES COURANTS DE RETOUR ENGENDRES PAR UN JET CONFINE]

Moises S. Barchilon (Grenoble Univ.) 1969 105 p refs In FRENCH

(Rept-442) Avail: Issuing Activity

The turbulent mixing of a jet of an incompressible fluid with an ambient fluid of the same general nature was experimentally studied in the interior of a circular cylinder tube. The initial velocity of the ambient fluid was weak enough so that the jet induced a recirculation eddy in the conduit. Tracings were made of the average current lines for different ratios of the initial velocities of the two fluids, beginning with a measure of average pressures and velocities in the axial plane of the cylinder model in water. The structure of instantaneous flow was observed photographically; the visualization of the liquid trajectories was seen as fine droplets of air. An examination of the photographs showed that the recirculation eddy is a complex vortical structure, evolving almost periodically in the course of time. This structure is bound, in the downstream portion of the recirculation eddy, to the raised levels of turbulence measured by the apparatus functioning in air. Transl. by B.P.

N69-27278# Lockheed Missiles and Space Co., Palo Alto, Calif.

ANALYSIS OF A RADIATING GAS FLOW IN A SHOCK LAYER

O. M. Belotserkovskii et al 1969 16 p refs Transl. into ENGLISH From Vichisl. Mat. i Mat. Fiz. (USSR), v. 9, no. 2, 1969 p 397-412

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Applications of numerical methods to the analysis of supersonic flow around blunt bodies, with radiation taken into account, are summarized. Results of computations made for various assumptions relative to the nature of the radiation, such as volume de-excitation, selective de-excitation, selective radiation, and absorption, are presented. The selective character of the radiation in the shock layer, radiation transport in a continuous spectrum, and a set of weak spectrum lines are considered. The system of equations, boundary conditions, and numerical schemes developed on the basis of the integral relations method are discussed. All the computations were made under the assumption of the presence of local thermodynamic gas equilibrium. Author

N69-27279# Argonne National Lab., Ill. Reactor Engineering Div.

INTERACTION OF TWO-DIMENSIONAL STRATIFIED, TURBULENT AIR-WATER AND STEAM-WATER FLOWS

John H. Linehan (Ph.D. Thesis—Wis. Univ., Madison) May 1968 103 p refs

(Contract W-31-109-ENG-38)

(ANL-7444) Avail: CFSTI

Analytical models based on an integrated form of the boundary layer type equation are developed to describe the interaction of two dimensional, stratified, turbulent, two phase fluids. Particular emphasis was placed on the description of flows whereby the gas phase velocity is at least an order of magnitude larger than the liquid phase velocity and the gas-phase momentum is the same order of magnitude as the liquid phase momentum. Under these circumstances, where the momentum transferred from the gas phase to the liquid phase plays a significant role in the behavior of the liquid, the liquid phase occupies a small portion of the flow and is referred to as a film. In turbulent flow, the phase interface is generally characterized by a complex wave structure. For two component flows, correlations were proposed for the determination of the momentum transferred from the gas phase to the film via turbulent shear stress. Author (NSA)

N69-27312*# Naval Postgraduate School, Monterey, Calif.
FLUERICS. 25: THE DEFLECTION OF PLANE TURBULENT JETS BY CONVEX WALLS, PART 1
Turgut Sarpkaya Washington, D. C. HDL 1 Nov. 1968 52 p refs
(MIPR Order R-68-4)
(AD-683496; HDL-R-68-4-1) Avail: CFSTI CSCL 13/7

A convex wall and the mechanism of high pressure recovery in convex-walled bistable amplifiers are investigated. The results are presented in terms of normalized parameters in a form suitable for comparison with theoretical results. Reasonably good agreement is obtained between the experimental results and those predicted theoretically by Gortler and Glauert, particularly for regions of flow away from the control port. The effects of the wall setback and control port are most pronounced in a region near the power nozzle where normalized maximum velocity attains values as high as 1.20. Author (TAB)

N69-27326# Bangalore Univ. (India). Univ. Coll. of Engineering.
A SINGULAR PERTURBATION PROBLEM OF LAMINAR FLOW BETWEEN POROUS DISKS
N. Rudraiah, B. C. Chandrasekhara, and R. H. Nagabhushana Nov. 1968 16 p refs
(PGSAM-3) Avail: CFSTI

The flow between parallel porous disks with uniform suction at the disks is considered for large Reynolds number. The equations of motion are solved using the Singular Perturbation technique. The expressions for velocity, pressure and shear stress distributions were obtained for large R and these results are compared with those of Elkouh for small Reynolds number. It was found that the effect of large suction at the disks is to decrease the pressure coefficient and tc increase the skin friction coefficient. The results obtained are of practical interest in the design of thrust bearings, radial diffusers and in the theory of electromagnetic lubrication. Author

N69-27379# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
ON THE ENTRY FLOW IN A CIRCULAR CYLINDRICAL TUBE AT ARBITRARY REYNOLDS NUMBERS
H. S. Lew and Y. C. Fung Sep. 1968 44 p refs
(Grant AF-AFOSR-1186-67)
(AD-683346; AFOSR-69-0061-TR) Avail: CFSTI CSCL 13/11

The steady axisymmetric flow in the inlet region of a circular cylindrical tube is studied on the basis of Oseens equation. The article presents a solution of the steady entry flow in a circular cylindrical tube at an arbitrary Reynolds number with an arbitrary axisymmetric distribution of velocity at the entry section. Numerical results are presented for the case of uniform entry in a Reynolds number range 0 to 100. Author (TAB)

N69-27408# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS DYNAMICS, VOLUME 1
Kh. A. Rakhmatulin et al 9 Aug. 1968 282 p refs Transl. into ENGLISH of the book "Gazovaya Dinamika" Moscow, Vysshaya, Shkola, 1965 p 1–722
(AD-683134; FTD-MT-24-132-68-Vol-1) Avail: CFSTI CSCL 20/4

Contents: Thermodynamics; Equations of motion of a gas; One-dimensional steady motion of a gas; Motion of a gas with light disturbances. TAB

N69-27409# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS DYNAMICS, VOLUME 2
Kh. A. Rakhmatulin et al 9 Aug. 1968 249 p refs Transl. into ENGLISH of the book "Gazovaya Dinamika" Moscow, Vysshaya Shkola, 1965 p 1–722
(AD-683135; FTD-MT-24-132-68-Vol-2) Avail: CFSTI CSCL 20/4

Contents: One-dimensional nonsteady motion of a gas with finite disturbances; Steady supersonic flow of a gas with finite disturbances; Flow around solids of revolution by a supersonic steady gas flow; Blast waves(self-similar problems); Plane subsonic motion of a gas with finite disturbances. TAB

N69-27410# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS DYNAMICS, VOLUME 3
Kh. A. Rakhmatulin et al 9 Aug. 1968 271 p refs Transl. into ENGLISH of the book "Gazovaya Dinamika" Moscow, Vysshaya Shkola, 1965 p 1–722
(AD-683219; FTD-MT-24-132-68-Vol-3) Avail: CFSTI CSCL 20/4

Contents: The boundary layer and problems of aerodynamic heating; Flow of a rarefied gas; Physical bases of the theory of a radiating gas. TAB

N69-27427# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
AEROSOL TRANSPORT IN A CONDENSING STREAM ENVIRONMENT
J. M. Hales 20 Feb. 1969 16 p refs Presented at the 8th Meeting of the U.S. Can. Reactor Safety Comm., Oak Ridge, Tenn., 20 Feb. 1969
(Contract AT(45-1)1830)
(BNWL-SA-2359; CONF-690203-1) Avail: CFSTI

An examination of the fundamental processes influencing the formation and behavior of boundary layers in condensing-steam systems is described. The examination is particularly concerned with the transport of aerosol particles. NSA

N69-27445 University of Southern Calif., Los Angeles.
FLOW STUDIES WITH AN IMPROVED DIFFRACTION GRATING INTERFEROMETER AND A NEW COLOR SCHLIEREN METHOD FOR QUANTITATIVE ANALYSIS
Arthur Reginald Maddox (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-17033

A simple Schlieren system was converted into a Kraushaar interferometer by the addition of matched diffraction gratings as the beam splitting and recombining elements. Optical quality of the added features of this installation was shown to be not a limiting factor, but the optical platform must be well isolated for good results. Several aspects are indicated which enhance the fringe or image quality. Various techniques for introducing color in the Schlieren system were explored, and all were found to have drawbacks such that the added dimension of color in a Schlieren has never been utilized for extensive quantitative measurements. An entirely new type of device was introduced which is a departure from the conventional Schlieren system and provides solutions to the problems of sensitivity, range of measurement deflection and undesirable effects of diffraction. Author

N69-27479# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF WAVE PHENOMENA IN THE STEADY FLOW OF AN INVISCID STRATIFIED FLUID [ETUDE DES PHENOMENES D'ONDES DANS LES ECOULEMENTS STATIONNAIRES D'UN FLUIDE STRATIFIE NON VISQUEUX]

Rady Adour Kh. Zeytounian 1969 96 p refs In FRENCH; ENGLISH summary
(ONERA-P-126) Avail: CFSTI

The equations are written for the problem of a stratified fluid above an obstacle of arbitrary shape. This formulation, in a steady regime for an inviscid fluid, takes into account the non-linear convection phenomena and, in particular, the vertical accelerations. Different theoretical models are considered. With these models, it is possible to study the wave pattern downstream of an obstacle within a baroclinic atmosphere. Results about the flow of a mass of stratified air above irregular ground are presented. Two models are considered: a plane, nonlinear flow, and a three-dimensional, linearized flow combined with the interaction of a thermal boundary layer with the free inviscid flow. With the computing methods presented it is possible to obtain, for any arbitrary shape, the flow configuration above and downstream of this obstacle as a function of the generalized FROUDE number. Some numerical results are presented. Author

N69-27595# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE EFFECTS OF FLOW INCLINATION ON HOT-FILM ANEMOMETER PROBES Technical Report, Jan. – Aug. 1968
Robert J. Vidal May 1969 22 p refs
(CAL-VH-2556-A-1) Avail: Issuing Activity

An existing theoretical description of the hot-film anemometer is reviewed to establish a quantitative basis for examining the effects of flow inclination on the velocity inferred with a typical anemometer configuration. The inclination effects are calculated with this theory and with an existing solution for the boundary layer on a yawed cylinder. It is shown that this probe configuration is sensitive to small angles of inclination and a 5° misalignment could produce errors of 30% to 45% in the inferred velocity. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-26210# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GEOCEIVER: AN INTEGRATED DOPPLER GEODETIC RECEIVER
Thomas A. Stansell, W. A. Bourguignon, C. R. Karl, and P. C. Marth Nov. 1968 267 p Revised
(Contract NOw-62-0604-C)
(AD-683665; APL-TG-710-Rev) Avail: CFSTI CSCL 8/5

The name geoceiver is an abbreviation for Geodetic Receiver, chosen because the geoceiver promises to play a significant role in extending our geodetic knowledge. For the first time, a truly man-portable satellite tracking station will be available for the accurate mapping of relatively inaccessible or remote areas. This document describes the proposed geoceiver hardware design and operational characteristics. Geoceiver is based on the integrated doppler satellite measurement technique. Author (TAB)

N69-26256# Army Foreign Science and Technology Center, Washington, D.C.
AUTOMATING ENTRY OF INSCRIPTIONS AND OUT-OF-SCALE SYMBOLS ON PUBLISHER'S MAPS
V. A. Nikolaeva 10 Feb. 1969 11 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 3, 1968 p 69–72
(AD-683184; FSTC-HT-23-716-68) Avail: CFSTI CSCL 8/2

The report gives a description of recent developments in photo composition, which the authors considered to be advisable for application in map production. At the present time, the two main ways of automating photo composition and map making are: (1) photo composition of inscriptions and symbols with subsequent automatic coordinate placement, and (2) photo composition with semi-automatic placement. This article presents a technological outline of these two methods for large-scale operations. Author (TAB)

N69-26346*# Texas Instruments, Inc., Dallas. Electronic and Optical Systems Dept.
RS-14 DUAL CHANNEL AIRBORNE INFRARED IMAGING SYSTEM Final Report
28 Mar. 1969 435 p refs
(Contract NAS9-7575)
(NASA-CR-99666; DM-69/3-37) Avail: CFSTI CSCL 08G

After a brief review of the history of the project, a functional description of the system is provided. The RS-14 dual channel airborne infrared imaging system is a line scan radiometer system, that includes a complete scanning instrument with remote control and display, for manual operation in the aircraft. Results of the electromagnetic interference, acceptance, vibration, and environmental tests are included and are reported to be satisfactory. The RS-14 system is intended for use, in the earth resources survey program, in radiant and reflective energy experiments, as applied to geological and agricultural parameters. P.A.B.

N69-26382# Ministère des Affaires Culturelles, Luxembourg.
THE DISTRIBUTION OF THE EARTH MAGNETIC FIELD IN THE GRAND DUCHY OF LUXEMBOURG ON 1 JANUARY 1965 [LA DISTRIBUTION DU CHAMP MAGNETIQUE TERRESTRE AU GRAND-DUCHE DE LUXEMBOURG AU 1ER JANVIER 1965]
A. de Vuyst and J. Pohl 1968 14 p In FRENCH
Avail: CFSTI

Within the framework of the World Magnetic Survey (WMS) magnetic measurements were carried out in the grand duchy of Luxembourg during June 1968. The horizontal intensity H and the total intensity F were measured at 51 stations. The vertical intensity Z and the inclination I were computed. The results were reduced to the period 1965.0 and are presented in tables and charts. ESRO

N69-28422# Air Force Cambridge Research Labs., Bedford, Mass.
SCINTILLATION OBSERVATIONS OF SYNCHRONOUS SATELLITES
Jules Aarons, Herbert E. Whitney, and Richard S. Allen Jan. 1969 19 p refs
(AD-683241; AFCRL-69-0011) Avail: CFSTI CSCL 4/1

During 1967 and early 1968, it was possible to record amplitude scintillations from synchronous satellites over simultaneous periods of time from the Sagamore Hill Radio Observatory (54 degrees G.N.). Three satellites transmitted at 137 MHz; these were ATS-1 on the western horizon (-0.1 degrees to +0.75 degrees elevation), Canary Bird on the eastern horizon (7 degrees to 12 degrees elevation), and ATS-3 toward the south (greater than 200 degrees azimuth and greater than 39 degrees elevation). In addition, the beacon of the near synchronous satellite LES-5 was recorded at 228 MHz. The basic pattern of scintillation was for a maximum to occur at midnight for the satellite observed in the southerly direction, and two hours earlier for the satellite observed to the east showing the effect of the time difference for the two ionospheric regions. During the summer particularly, and occasionally at other times, a secondary peak of scintillation was observed near local

noon. Winter nighttime scintillation indices were generally lower than summer values. LES-5 observations at this latitude show occasional fades down to 20 dB. Individual fades last from several seconds to several minutes. The duration of fading periods varied from a few minutes to several hours. Author (TAB)

N69-26484# Ohio State Univ., Research Foundation, Columbus. Dept. of Geodetic Science.
PREDICTION ACCURACIES OF 5° × 5° MEAN ANOMALIES FROM 1° × 1° MEANS AT DIFFERENT LATITUDES
Gabriel F. T. Obenson Nov. 1968 48 p refs
(Contract AF 19(628)-5701; OSURF Proj. 2122)
(AD-683779; Rept-117; SR-26; AFCRL-68-0642) Avail: CFSTI CSCL 8/5

Covariance functions for 5 ft x 5 ft and 1 degree x 1 degree blocks are derived from the covariance function for point anomalies at different latitudes. Using the 1 degree x 1 degree covariance function at certain latitudes and different 1 degree x 1 degree configurations, prediction accuracies for 5 degree x 5 degree blocks are studied for three different methods. It is shown that the accuracies are generally the same for any one method at different latitudes for any given 1 degree x 1 degree configuration. If the number of 1 degree x 1 degree blocks in any 5 degree x 5 degree block is more than about ten, the arithmetic mean method gives practically the same accuracy as the minimum variance method even if all known 1 degree x 1 degree blocks are used. Author (TAB)

N69-26558# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
GRAVIMETER IN A GONDOLA [GRAVIMETR V GONDOLE]
L. A. Gubarenko and A. V. Staklo Jan. 1969 7 p Transl. into ENGLISH from Priroda (Moscow), no. 4, 1968 p 117–119
(AD-683910; ACIC-TC-1482) Avail: CFSTI CSCL 8/5

Present gravity observations at sea are made on surface ships and on board submarines. These vessels present certain disadvantages because of the sea swell and because the coordinates of the submerged submarine cannot be determined with desired accuracy. A new method for gravity measurements at sea has been introduced. The device consists of a gondola which houses the measuring instruments and a dynamic sinker. With the aid of the sinker, the hermetical gondola, which has a certain buoyancy, decends to 100 meters, and in such a position is towed behind the ship. Gravity is measured with the aid of an automatic string gravimeter. Certain difficulties are caused by the movements of the gondola, though not so great as on a surface ship. A set of auxiliary instruments is installed in order to correct all disturbances. The new method for gravity measurement was tested in the Baltic and Black Seas. Author (TAB)

N69-26604# Israel Program for Scientific Translations, Ltd., Jerusalem.
GEOPHYSICAL EXPLORATIONS IN THE SOVIET ARCTIC AND ANTARCTIC [GEOFIZICHESKIE ISSLEDOVANIYA V SOVETSKOI ARKTIKE I ANTARKTIKE]
A. P. Nikol'skii, ed. et al 1968 126 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkticheskogo Nauchn. Issled. Inst. Gl. Upr. Sev. Morsk. Puti Min. Morsk. Flota SSSR (Leningrad), v. 241, no. 4, 1962 Published for NSF *Its* Cat. No. 5051
(TT-68-50316) Copyright. Avail: CFSTI

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N69-26605# Israel Program for Scientific Translations, Ltd., Jerusalem.
STOERMER'S THEORY AND MODERN AERONOMY [TEORIYA STOERMERA I SOVREMENNAYA AERONAMIYA]
A. P. Nikol'skii *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 1–15 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Reviewed is Stoermer's theory that the Sun emits streams of neutral particles into the interplanetary space and thus induces auroras and magnetic disturbances in the Earth's magnetosphere. New facts and regularities discovered in these phenomena seem to indicate the following: (1) the calculated field of the terrestrial magnetic dipole does not seem to be identical with the real field; (2) the magnetic fields of larger anomalies extend to a much higher altitude than assumed; (3) the terrestrial magnetic field becomes largely distorted at higher altitudes by entering corpuscular streams; and (4) the entry of solar particles into high latitudes is affected by the Earth's radiation belt. G.G.

N69-26606# Israel Program for Scientific Translations, Ltd., Jerusalem.
ON THE NATURE OF THE ANOMALOUS NOCTURNAL IONIZATION OF THE F_2 LAYER IN HIGH LATITUDES [K VOPROSU O PRIRODE ANOMAL'NOI NOCHNOI IONIZATSII SLOYA F V_2VYSOKIKH SHIROTAKH]
A. S. Besprozvannaya *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 16–24 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Suggested is a new hypothesis for the origin of the abnormally high ionization of the F-2 layer in high latitudes during polar nights. It is proposed that this ionization is due to particles comprising the slow corpuscular radiation continuously emitted by the Sun. Author

N69-26607# Israel Program for Scientific Translations, Ltd., Jerusalem.
ON THE POSSIBLE CAUSES OF THE IRREGULAR MOTIONS OF IONIZATION CLOUDS RELATED TO AURORAS [O VOZMOZHNYKH PRICHINAKH NEREGULYARNYKH DVIZHENII OBLAKOK IONIZATSII, SUYAZANNYKH S POLYARNYMI SIYANIYAMI]

A. P. Nikol'skii *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 25–36 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Described are the physical mechanisms generating the ionospheric winds. It is suggested that the rotation of the Earth under the precipitation spiral of solar particles, fixed with respect to the Sun, will be perceived by an observer on Earth as ionospheric wind. Author

N69-26608# Israel Program for Scientific Translations, Ltd., Jerusalem.
PULSATIONS OF THE GEOMAGNETIC FIELD IN HIGH LATITUDES [PUL'SATSII GEOMAGNITNOGO POLYA V VYSOKIKH SHIROTAKH]
A. I. Ol' *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 37–65 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Discussed is a new type of long-period giant pulsations which have been discovered on the high-latitude records of the terrestrial magnetic field. Their period is now known to be dependent upon the geomagnetic latitude. They are presumed to be caused by magnetohydrodynamic waves propagated along the lines of force of the terrestrial magnetic field. Author

N69-26609# Israel Program for Scientific Translations, Ltd., Jerusalem.
MAGNETIC FIELD VARIATIONS IN THE DRIFT AREA OF THE "SEVERNYI POLYUS-4" AND "SEVERNYI POLYUS-5" STATIONS IN 1955/1956 [VARIATSII MAGNITNOGO POLYA V RAIONE DREIFA STANTSII "SEVERNYI POLYUS-4" I "SEVERNYI POLYUS-5" 1955/1956 G]
N. A. Milyaev *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 66–83 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Investigated are geomagnetic field variations in the drift area of two North Pole ground stations in 1955–56. The diurnal variations of the terrestrial magnetic field elements have been found and their relationship to magnetic activity elucidated. The discovered regularities agree with the hypothesis concerning the shift in the position of the auroral zone during the different phases of the 11-year cycle of solar activity. Author

N69-26610# Israel Program for Scientific Translations, Ltd., Jerusalem.
MAGNETIC DISTURBANCES IN THE AREA OF CAPE SHMIDT AND UELEN [MAGNITNYE VOZMUSHCHENIYA V RAIONE MYSA SHMIDTA I UELENA]
L. N. Zhigalov et al *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 84–93 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Detailed studies of extensive data on magnetic disturbances in the eastern sector of the Arctic found diurnal, seasonal, and cyclic variations of magnetic activity. Also determined was the existence of a second (circumpolar) zone of magnetic activity, but only in summer and in the morning hours. Author

N69-26611# Israel Program for Scientific Translations, Ltd., Jerusalem.
STRUCTURE OF THE IRREGULAR PART OF THE MAGNETIC DISTURBANCE FIELD ON CAPE CHELYUSKIN [STRUKTURA NEREGULYARNOI CHASTI POLYA MAGNITNYKH VOZMUSHCHENII NA MYSE CHELYUSKINA]
A. P. Nikol'skii *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 94–103 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

Stoermer's theory of neutral particle stream emission from the Sun is used to explain the shift in the times of maximum diurnal activity associated with variations in geomagnetic activity. Isochrones for the morning maximum of magnetic disturbance constitute a system of spirals issuing from the pole, having uniform magnetization, and evolving clockwise in the Arctic and counterclockwise in the Antarctic. The Arctic circumpolar region contains a second zone with high occurrence of magnetic disturbances and auroras. Active periods of magnetic disturbance occur mainly at certain hours of the day and are attributed to solar protons. G.G.

N69-26612# Israel Program for Scientific Translations, Ltd., Jerusalem.
ON THE RELATIONSHIP BETWEEN AURORAS, AND IONOSPHERIC AND MAGNETIC DISTURBANCES IN THE ANTARCTIC [O SVYAZI MEZHDU POLYARNYMI SIYANIYAMI, IONOSFERNYMI I MAGNITNYMI VOZMUSHCHENIYAMI V ANTARKTIKE]
V. S. Ignatov *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 104–114 refs (See N69-26604 14-13)
Copyright. Avail: CFSTI

This paper provides a correlation between magnetoionospheric disturbances and auroras according to observations performed at a ground station in the region of the South Geomagnetic Pole. Results show that the majority of auroral displays appeared in a quiet magnetic field; a majority of magnetic disturbances was accompanied by ray forms. A fairly close relationship was established between auroras and the incidence of night and the sporadic layers in the E region. Intensification of magnetic activity was often accompanied by an activity increase in the lower ionosphere. G.G.

N69-26613# Israel Program for Scientific Translations, Ltd., Jerusalem.
SECULAR VARIATION OF MAGNETIC ELEMENTS ACCORDING TO DATA SUPPLIED BY THE SOVIET MAGNETIC POLAR OBSERVATORIES [VEKOVOI KHOD MAGNITNYKH ELEMENTOV PO DANNYM SOVETSKIKH MAGNITNYKH POLYARNYKH OBSERVATORII]
R. G. Kokorin *In its* Geophys. Explorations in the Soviet Arctic and Antarctic 1968 p 115–120 (See N69-26604 14-13)
Copyright. Avail: CFSTI

Observations of the permanent terrestrial magnetic field in the Soviet Arctic over a number of years are summarized in table form. Mean annual values of declination, horizontal, and vertical components for all days were used to obtain the secular variation of magnetic elements. G.G.

N69-26662*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
A DETERMINATION OF THE HELIUM AND NITROGEN CONTENT OF THE LOWER THERMOSPHERE (110 to 155 km) ABOVE FT. CHURCHILL, CANADA [EINE MESSUNG DES HELIUM- UND STICKSTOFFGEHALTS DER UNTEREN THERMOSPHÄRE (110 BIS 155 km HOEHE) UEBER FT. CHURCHILL, KANADA]
G. Hartmann and D. Mueller Washington NASA Apr. 1968 62 p refs Transl. into ENGLISH of Federal Min. for Sci. Res. rept. W68-54
(Contract NASw-1692)
(NASA-TT-F-12112) Avail: CFSTI CSCL 04A

On December 12, 1968 at 1305 L.T. a quadrupole mass filter, which was specifically designed to determine the helium content of the upper atmosphere, was flown in a Black Brant III rocket from Ft. Churchill, Canada. Besides helium, the number densities of nitrogen and oxygen were obtained. The measured

helium content is higher than predicted in CIRA 1965 by a factor of 5. This implies a level for the helium turbopause 10 km lower than assumed in CIRA 1965. This measurement is in agreement with the winter helium bulge theory of the upper atmosphere, deduced from satellite drag data. Author

N69-26664*# Norton Research Corp., Cambridge, Mass.
DEVELOPMENT OF ABRASION SAMPLING TECHNIQUES FOR EXTRATERRESTRIAL GEOLOGICAL ANALYSIS Final Report, 6 Jul. 1967–5 Aug. 1968
P. Blum Oct. 1968 86 p refs
(Contract NASw-1616)
(NASA-CR-101136) Avail: CFSTI CSCL 08G

A rock comminution method was developed for acquiring powder specimens compatible with requirements for automated extraterrestrial geological analysis. The production of thin parallel ridges on the rock surface and their subsequent removal by planning produced powder size distributions approaching that desired for petrographic microscopy. Results on both basalt and obsidian were similar, indicating that the method is suitable for diverse rock types. Prototype concepts are discussed. A vacuum system was designed and constructed for advanced studies. It incorporates a commerical surface grinder, retaining its directional versatility, precision, and stability. Preliminary vacuum grinding tests showed powder trajectories exhibiting aerodynamic swirling effects at simulated Martian pressures of 4 Torr, but exhibiting ballistic patterns at 0.1 Torr. Powder adherence to grinding wheels was also observed at these pressures. Author

N69-26671 Texas Univ., Austin.
EXPERIMENTAL DETERMINATION OF THE DYNAMIC ELASTIC PROPERTIES OF ANISOTROPIC ROCKS, ULTRASONIC PULSE METHOD
Augusto Podio-Lucioni (Ph.D.Thesis) 1968 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-16125

The velocities of longitudinal and shear ultrasonic waves were measured in two anisotropic rocks and in one isotropic rock. Orientation of the direction of propagation was varied with respect to the orientation of bedding planes. Using equations for plane wave propagation in elastic, transversely isotropic materials, and experimentally determined velocities of propagation, it was possible to calculate dynamic elastic coefficients, and Hooke's elastic constants of the rocks tested. It was observed that the rocks exhibited a moderate degree of wave velocity anisotropy. It was also observed that the maximum wave velocities were obtained for spherical stress state, and that a decrease in velocity occurred for a decrease in effective stress due to increasing pore pressure. In Leuders Limestone, it was observed that a large reduction in compressional and shear wave velocities occurred. Dissert. Abstr.

N69-26675 Columbia Univ., New York.
PROPAGATION OF ACOUSTIC GRAVITY WAVES IN THE ATMOSPHERE
Nambath Krishnan Balachandran (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-16894

A linear perturbation theory for the propagation of acoustic-gravity waves in a multi-layer model of the atmosphere with constant temperature and uniform wind in each layer is developed. Normal mode solutions are derived. The final frequency equation is solved by an iterative procedure giving rise to a number of modes of solution. Dispersion curves for various atmospheric models with wind are presented. It is found that short period waves (less than about 400 sec) are influenced mainly by winds close to the ground whereas long period waves (more than about 400 sec) are influenced by high-altitude as well as low-altitude winds. Strong winds at altitudes near 100 km, along the direction of propagation of the waves and winds near the ground blowing in a direction opposite to that of the waves, are found to be favorable for inverse dispersion at long periods. Pressure records from a number of nuclear tests in the atmosphere are subjected to Fourier analysis, and the empirical group velocity dispersion curves are plotted. Dissert. Abstr.

N69-26687# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
PROBLEMS OF GEOTECTONICS IN CHINA
Kuo-ta Ch'en et al Oct. 1968 392 p refs Transl. of the book "Chung-kuo Te-Ti Kou-Tsao Wen-T'i" Peking, Sci. Press, Nov. 1965 p 1–183
(AD-677423; ACIC-TC-1382) Avail: CFSTI CSCL 8/7

The book is the research results of some tectonic geologists in China in recent years. A total of eight articles in this field are collected in this book. This collection investigates the four major problems: (1) The architectonic characteristics in China and the principle of development; there are three different viewpoints on this subject: 'The Theory of the Interior Lowland,' 'The Theory of Mosaics,' and 'The Theory of Inherited and superimposed Structures' (2) The pre-cambrian architectonic problems of the Eastern part of China, with the emphasis upon the characteristics of tectonic changes during the early archeozoic era; (3) Architectonics of the mesozoic-cenozoic oil-bearing basins in China; and (4) Architectonic problems in the Southeastern region of China. This book is suitable as a reference for research workers in geology, geotectonics and petroleum geology, and related instructors.
Author (TAB)

N69-26726 Oklahoma Univ., Norman.
SOME EFFECTS PRODUCED BY THE ACTION OF EDDY VISCOSITY ON THE SEMIDIURNAL TIDAL WIND NEAR THE MESOPAUSE
Victor Shelby Whitehead (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-17493

The effects of viscosity on atmospheric motions are small enough to be considered insignificant in many areas of meteorology. Molecular viscosity has very little effect on atmospheric circulation except very near the surface and at altitudes above about 110 km. Elsewhere eddy viscosity is so much greater that it masks the effects of the molecular term. Even the effects of eddy viscosity are generally ignored in many meteorological applications. In the upper mesosphere and lower thermosphere, however, the eddy viscosity term becomes large enough to be considered important, even for large scale phenomena such as the tidal motions which are so pronounced in this region. Models are developed which depict some of the effects which the action of eddy viscosity would have on the observed semidiurnal tidal wind. Dissert. Abstr.

N69-26733 Texas Univ., Austin.
SONIC INVESTIGATION OF THERMAL INVERSION LAYERS OF THE ATMOSPHERE
Alex Roscoe Thomas, Jr. (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-16148

Continuous measurement of thermal inversions of the troposphere by sonic pulses is discussed. The method depends upon the reflection of the signal by the thermal inversion layers. In the experiment a low frequency sonic pulse is transmitted and the reflected signal received by use of a large parabolic reflector. The received signals are presented graphically in order to determine the

presence of a thermal inversion. Concurrent wiresonde measurements are also presented to collaborate the validity of these tests. Dissert. Abstr.

N69-26741*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE GEOMAGNETIC TAIL AT 500 EARTH RADII BY PIONEER 8
N. F. Ness and F. Mariani (Rome Univ.) Feb. 1969 27 p refs Submitted for publication
(NASA-TM-X-63543; X-616-69-54) Avail: CFSTI CSCL 08N

In January 1968, Pioneer 8 passed through the extended geomagnetic tail region at 470–580 R_E downstream of the solar wind interaction with the geomagnetic field. Magnetic field observations suggest detection of the geomagnetic tail similar in characteristics to that observed by Pioneer 7 at 1000 R_E, but for a higher percentage of time when in the region of an extended, aberrated tail. Author

N69-26802# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
IONOSPHERIC RESEARCH Final Report, 1 Sep. 1963–30 Nov. 1968
Arthur H. Waynick 30 Nov. 1968 60 p refs
(Contract AF 19(628)-4014)
(AD-683336; AFCRL-68-0658) Avail: CFSTI CSCL 4/1

The report contains theoretical and experimental investigations on the physics, dynamics and aeronomic properties of the earths and other planetary atmospheres. Also involved were theoretical and experimental studies of various relevant atomic and molecular rate coefficients. Author (TAB)

N69-26815# Deutscher Wetterdienst, Offenbach am Main (West Germany).
INVESTIGATIONS OF SOME PROPERTIES OF METEOROLOGICAL PARAMETERS BELOW 80 KM Final Report, Mar. 1967–Oct. 1968
Heinrich Faust and Eva Soos Nov. 1968 155 p refs
(Contract DAJA37-67-C-0475)
(AD-683506) Avail: CFSTI CSCL 4/2

The report discusses the analysis of wind profiles in the upper atmosphere. High latitude wind profiles are investigated and classified into 45 categories, 9 depicting the lower dynamic system (Faust Cellular Theory) and 5 depicting the upper dynamic system. Mean wind and temperature profiles of Eastern and Western Canada are discussed as are the variability of temperature in the stratosphere and mesosphere. Times of spring transition meridional cross sections of the zonal wind at different longitudes and temperature deviations from multi annual means. The major section of the report is devoted to the investigation of the structure of the atmosphere over areas of pressure changes. He finds that the 20 km level represents a genuine separating layer but that it is not impenetrable and that proof of an effective influence from top to the bottom at the atmosphere that would be useful in weather forecasting would require a worldwide rocket network. Author (TAB)

N69-26817# Army Foreign Science and Technology Center, Washington, D.C.
RESULTS OF EXPERIMENTAL WORK OF THE TsNIIGAiK (CENTRAL SCIENTIFIC RESEARCH INSTITUTE OF GEODESY, AERIA MAPPING AND CARTOGRAPHY) ON LARGE-SCALE SURVEYS
N. A. Sokolova [1969] 21 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 7, 1968 p 34–45
(AD-683491; FSTC-HT-23-672-68) Avail: CFSTI CSCL 8/2

The TsNIIGAiK has conducted experimental work for developing methods for topographic surveying at 1:5,000 and 1:2,000. During 1965-1966 experimental photogrammetric work was done for the following purposes: Clarifying the accuracy in determining the elevations of terrain points on universal stereophotogrammetric instruments from large-scale aerial photographs taken with different aerial cameras; finding the accuracy in determining horizontal coordinates on universal instruments; determining the accuracy in statoscope readings during flights at low altitudes and selecting the best method for adjusting photogrammetric elevations on the basis of statoscope readings. The results of the evaluation of accuracy in determining the horizontal position of points from photogrammetric extension indicates that the mean square errors M sub xy will be plus or minus 0.25 - 0.30 mm at plan scale if the distance between control points in 5-6 km when making a survey at 1:5,000 and 2-2.5 km for a survey at 1:2,000. Author (TAB)

N69-26965# White Sands Missile Range, N.Mex. Atmospheric Sciences Office.
ROCKET MEASUREMENTS OF THE DIURNAL VARIATION OF ATMOSPHERIC OZONE
Jagir S. Randhawa Dec. 1968 32 p refs
(AD-683462; ECOM-5226) Avail: CFSTI CSCL 4/1

The rocket-borne ozonesonde, developed by the Atmospheric Sciences Research Office, White Sands Missile Range (WSMR), New Mexico, has been deployed for the study of diurnal variation of ozone in the stratosphere and mesosphere. Five ozonesondes were rocket-launched in January 1968 within a 24-hour period, and the data obtained showed ozone variations between day and night above the main ozone peak (22 km). Three additional ozonesondes were flown in July 1968, with similar ozone variations being observed. Two Mast ozonesondes were launched on balloons during these series of soundings, and data obtained by the two sounding systems agreed well in the region of overlap. Author (TAB)

N69-26969*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SURVEY AND COMPARATIVE ANALYSIS OF CURRENT GEOPHYSICAL MODELS
Jesco von Puttkamer Washington May 1969 66 p refs
(NASA-TN-D-5163) Avail: CFSTI CSCL 08E

By using currently accepted constants of geodesy, especially several different sets of oblateness coefficients, seven models of the geometry of the earth and its gravitational field are numerically derived and compared with each other and with a newly developed geopotential based on recent measurements of the secular and periodic perturbations of artificial satellite orbits. Conclusions are drawn which show, among other things, that the currently used NASA standard model deviates significantly from the best geoid, and that there are better analytical, as well as numerical, models by which improved approximation can be achieved. Also, it is shown that improvements in the numerical values of the used oblateness coefficients, rather than in their number, appear to have little influence on the values of the gravity, but that they affect the geometries significantly. Increasing the number of zonal harmonics coefficients, however, can lead to considerable improvements in the gravity model, at least in the range studied (up to and including J_{14}). Author

N69-26977# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 203
1 May 1969 60 p refs Transl. into ENGLISH from Russian publications
(JPRS-47983) Avail: CFSTI

This semimonthly serial publication consists of materials gathered from recent publications of the Sino–Soviet Block countries, presented in the form of abstracts, summaries, and occasional full translations of articles on the subjects reflected in the Table of Contents. Complete bibliographic information accompanies each article. Main topics covered include astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and space research. Author

N69-27004# Travelers Research Center, Inc., Hartford, Conn.
CLASSIFICATION OF WORLD DESERT AREAS
George M. Howe, Lawrence J. Reed, John T. Ball, George E. Fisher, and Gordon B. Lassow Dec. 1968 117 p refs
(Contract DA-1-T-06210)
(AD-683603; TR-69-38-ES) Avail: CFSTI CSCL 4/2

The report identifies and maps limits of arid and semiarid regions of the world through application of aridity criteria quantitatively expressed in terms having military significance. Because the dry world includes a wide range of thermal characteristics, from extremely hot deserts of North Africa to extremely cold semiarid Asia, subdivisions were based on features of monthly temperature. The worldwide distribution of arid and semiarid conditions is presented on one map. Details of both aridity and thermal classification are shown on eight continental and sub-continental maps for Eurasia, Southwestern Asia, North Africa, South Africa, Australia, South and Central America, Europe, and North America. Aspects of climate and terrain that are of significance to Army operations are described. Author (TAB)

N69-27016# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
IONOSPHERIC OBSERVATIONS OF VLF ELECTROSTATIC NOISE RELATED TO HARMONICS OF THE PROTON GYROFREQUENCY Progress Report
Stephen R. Mosier and Donald A. Gurnett Jan. 1969 17 p refs
(Contract Nonr-1509(06))
(AD-683666; Rept-69-5) Avail: CFSTI CSCL 4/1

An observation of electrostatic noise bands observed with the Javelin 8.46 sounding rocket is presented. It is shown that these noise bands are related to harmonics of the proton gyrofrequency. This observation is believed to be the first confirmation of ion gyrofrequency harmonic effects in the ionosphere. Author (TAB)

N69-27034# Defence Research Board, Ottawa (Ontario). Scientific Information Service.
METHOD OF COMPUTING GRAAFF-HUNTER ANOMALIES, AND ISOSTASY IN THE BAIKAL REGION
Yu. A. Zorin Aug. 1968 7 p refs Transl. into ENGLISH from Geol. i Geofiz. (USSR), no. 1, 1968 p 140–143
(AD-684026; T-503-R) Avail: CFSTI CSCL 8/7

Simpler schemes are developed to provide a sufficiently complete picture of the isostatic anomalies, based on the Graaff–Hunter anomalies or model earth anomalies. Expression for defining the Graaff–Hunter anomalies are given. It is pointed out that the sizes of these anomalies depend on the topographic smoothing parameters, i.e., the radius of smoothing and the type of weighting function. To bring the model earth anomalies closer in size and in sense to the isostatic anomalies, a more rigorous approach is taken in selecting the topographic smoothing parameters. Several methods of substituting a partial topographic correction for the complete correction are discussed. Author

N69-27038# Electro-Mechanics Co., Austin, Tex.
DEVELOPMENT OF AN ELECTRONIC SYSTEM FOR PROCESSING VARIABLE-AREA MAGNETOGRAMS Final Report, 15 Jan. 1968–14 Jan. 1969
Robert L. Waters, John D. Osburn, and Fred J. Morris 14 Jan. 1969 33 p
(Contract F19628-68-C-0152)
(AD-683786; AFCRL-69-0046) Avail: CFSTI CSCL 8/14

This program was the continuation of a developmental effort in the handling and processing of recorded earths magnetic field data. The desired output was intended to facilitate analysis of the solar-terrestrial relationships governing high magnetic activity in the earths magnetic field associated with degraded electromagnetic propagation. The technical program described emphasizes the processing of magnetograms and the modifications to the electronic system developed for scanning and digitizing the film records. The quality of the magnetograms from the seven participating observatories had a bearing on the accuracy of output data; therefore, the quality of the magnetograms from each observatory is discussed. Author (TAB)

N69-27048# Genoa Univ. (Italy). Istituto Geofisico e Geodetico.
GENOVA-MONTECAPELLINO OBSERVATORY: IONOSPHERIC DATA, JANUARY-DECEMBER 1968
[1969] 63 p
Avail: CFSTI

Ionospheric observations made at the Genova-Monte Capellino Observatory (Italy) in 1968 are reported. ESRO

N69-27070# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOACTIVE ISOTOPES IN THE ATMOSPHERE AND THEIR USE IN METEOROLOGY. SELECTED ARTICLES
V. Yu. Luyanas, M. E. Berlyand, E. L. Genikhovich, V. K. Demyanovich, and R. I. Onikul 2 Feb. 1968 26 p refs Transl. into ENGLISH from Radioaktivnye Zotopy v Atm. i Ikh Ispol'z. v Meteorol. Nauchn. Konf. po Yadernoi Meteorol. (Moscow), 1965 p 18–27, 380–391
(AD-683226; FTD-MT-24-368-67) Avail: CFSTI CSCL 4/2

Estimate of the rate of formation of certain radioactive isotopes in the atmosphere; influence of vertical distribution of temperature and speed of wind on atmospheric diffusion of radioactive impurities. TAB

N69-27072# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN DATA ABOUT ATMOSPHERIC TURBULENCE IN THE UPPER TROPOSPHERE AND LOWER STRATOSPHERE
E. K. Verle et al 23 Feb. 1968 45 p refs Transl. into ENGLISH from Tr. Dalnevost. Nauchno-Issled. Gidrometeorol. Inst. (USSR) no. 15, 1963 p 83–112
(AD-683933; FTD-MT-24-237-67) Avail: CFSTI CSCL 4/1

Special aircraft sounding with an IL-28 near Khabarovsk has provided data on the frequency and structure of turbulent zones at heights of 6-12 km and their relationship to upper level clouds, atmospheric thermodynamic processes, the tropopause, jet streams and the pressure field. The apparatus used, schematically shown in the Enclosure, is described briefly. During vertical sounding at the indicated heights 49% of all flights were without turbulence, 35% were with slight turbulence, 15% with moderate turbulence and 3% with moderate to strong turbulence. During horizontal sounding no turbulence was observed 56% of the time slight turbulence 37% of the time and moderate turbulence 7% of the time. Author (TAB

N69-27076# National Physical Lab., New Delhi (India). Radio Propagation Unit.

RESPONSE OF THE 1000-KILOMETER IONOSPHERE TO MAGNETIC STORMS

B. M. Reddy, D. R. Lakshmi, and L. H. Brace (NASA Goddard Space Flight Center) May 1968 39 p refs

(RPU-S43; SR-43) Avail: CFSTI

Measurements of electron concentration and electron temperatures by the Langmuir probe experiment of the Explorer 22 satellite during 1966 are employed to study the response of the topside ionosphere at 1000 km to magnetic storms. The analysis was limited to the American longitudes (50°W to 130°W) over a latitude range from 50°S geomagnetic to 70°N geomagnetic. The daytime response is characterized by various degrees of electron density enhancements over the whole latitude range, the winter high latitudes undergoing highest enhancement. The electron temperature changes are not so unique. During the nighttime, the storm effects on the electron density are rather mixed. For the two moderate storms studied, the nighttime electron density increased throughout the summer hemisphere, while for a much severer storm the enhancement occurred in both the hemispheres, but only at low and middle latitudes. An attempt is made to explain some of these features qualitatively. Author

N69-27091# Commissariat à l'Energie Atomique, La Hague (France).

EVALUATION OF ATMOSPHERIC CONTAMINATION BY PLUTONIUM WITH DISCRIMINATION OF THE NATURAL ACTIVITY [EVALUATION DE LA CONTAMINATION ATMOSPHERIQUE PAR DU PLUTONIUM AVEC DISCRIMINATION DE L'ACTIVITE NATURELLE]

Albert Clech and René Prevot Mar. 1969 17 p refs In FRENCH; ENGLISH summary

(CEA-R-3701) Avail: CFSTI

This study concerns the application of the aerosol sampling method to the discrimination of natural activity, using two filters of different stopping powers. The experimental results have been used to establish charts which make it possible to evaluate the atmospheric pollution by plutonium, and to know the margin of error. Author (ESRO)

N69-27102# Institute for Telecommunication Sciences and Aeronomy, Boulder, Colo.

A NEW TECHNIQUE FOR OBTAINING THE SPECTRAL ANALYSIS OF ATMOSPHERICS ARRIVING FROM PARTICULAR DIRECTIONS

W. L. Taylor, H. M. Burdick, and L. W. Eichacker May 1968 27 p refs

(AD-672804; ERL-75-ITS-65) Avail: SOD $.25 CFSTI CSCL 4/1

The paper describes the fundamentals of basic equipment employed in a new system designed to measure VLF attenuation rates using atmospherics. New techniques were developed to record the spectral components of transient signals arriving from within an adjustable azimuthal sector. The apparatus was operated during several periods of high thunderstorm activity to determine its accuracy and dynamic range. Author (TAB)

N69-27122# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECTRAL ABSORPTION OF LONG-WAVE RADIATION IN THE ATMOSPHERE

A. P. Yurgenson 20 Feb. 1968 19 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Leningrad), v. 277, 1966 p 11–19

(AD-683293; FTD-MT-24-15-68) Avail: CFSTI CSCL 20/6

The research done by Howard, Burch, and Williams is cited as leading up to other work concerned with the derivation of formulas for computing average absorption functions for selected wave lengths. The very real, current, problem facing the worlds weather service is how best to use weather satellites, and it is pointed out that installing suitable equipment in such satellites and using them for long periods of time would make it possible to amass a wealth of information concerning the physical condition of the atmosphere, the status of the underlying surface of the earth, or the upper limits of clouds. A preliminary stage is the amassing of material with respect to the investigation of transmission or absorption of departing longwave radiation in the layer between the earth and the upper limit of the troposphere, using a great many experimental observations and radiation measurements made over various geographic regions, and under different meteorological conditions. Research has already shown that there are three basic groups of overlapping absorption belts in the real atmosphere in the longwave band of the spectrum. These have been examined and the results are presented in tabular form. TAB

N69-27147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THERMALS WITH THE HELP OF GLIDERS

P. A. Vorontsov 2 Oct. 1968 29 p refs Transl. into ENGLISH from Tr. Glavnaya Geofiz. Observ. (Leningrad), no. 189, 1966 p 38–53

(AD-683542; FTD-MT-24-249-68) Avail: CFSTI CSCL 4/1

A review is presented of the results of studies made by Hess (1961), Vulfson (1961), and Parchevskiy (1958) on the structure of thermals. Results are given for similar experiments carried out by Soviet glider pilots during the 1964 All-Union Glider Contest at Orel. A short series of 15 barograms recorded by a glider at that time is analyzed to illustrate the methods used in a study of the structure of thermals. Characteristics analyzed included: air speed of the glider in and out of the thermals, glider rate of climb, number of thermals encountered per unit of flight distance (spirals) and flight time, speeds of the thermals, levels at which the thermals began and ended, their diameters, the frequencies of rising and descending currents, and the general type of thermal, i.e., streamlike or cellular. A discussion on the apparatus used to process the data includes an analysis of non-Soviet equipment and a brief description of two models of an apparatus proposed by the Main Geophysical Observatory. Author (TAB)

N69-27187# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN RESULTS OF INVESTIGATION OF ATMOSPHERIC SURFACE LAYER TURBULENCE

G. E. Lesnik 15 Nov. 1968 13 p Transl. into ENGLISH from Tr. Glavnaya Geofiz. Observ. (Leningrad), no. 205, 1967 p 194–197

(AD-684025; FTD-MT-24-379-68) Avail: CFSTI CSCL 4/1

Experimental data are given on dispersion and time of averaging for pulsations of wind speed and temperatures, correlation, structural, and spectral characteristics of turbulence over a wide interval of scales. Balance of energy of turbulence also is examined. Author (TAB)

N69-27192# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIMULATION OF THE TUNGUSKA EXPLOSION

I. T. Zotkin et al 3 Jul. 1968 21 p ref Transl. into ENGLISH from Priroda (Moscow), no. 6, 1966 p 81–89

(AD-683221; FTD-HT-23-409-68) Avail: CFSTI CSCL 19/4

A discussion is given of the peculiar radial fall of trees during the Tungus meteorite explosion. The topography of the area is described and the work of the eight seasonal field investigating expeditions to the area of the catastrophe is analyzed. The shock wave of the Tungus meteorite which imprinted itself in the area in the pattern of fall of trees, was caused by a flying meteorite breaking up at the end of its flight. The explosion was neither

chemical nor nuclear, but thermal. The shock wave was also found to be a combination of spherical and ballistic waves. A model of the shock wave formed by the breaking up of the meteorite is described. This model was made to resemble the original one in order to determine the exact process of the meteorite breakup. The process of propagation of the model shock wave and the results of the experiment is analyzed. The shape of the wave established its origin as ballistic. It is concluded that while the hypothesis of the ballistic nature of the shock wave answers many questions, it cannot yet provide all the details on the Tungus explosion. Author (TAB)

N69-27193# Puerto Rico Univ., Mayaguez. Coll. of Agriculture and Mechanical Arts.

STUDY OF IONOSPHERE PROPAGATION AT FREQUENCIES FROM 4 TO 64 MHz Final Report, Mar. 1964–Feb. 1967

Braulio Dueno Bedford, Mass. AFCRL Jul. 1968 44 p (Contract AF 19(628)-3999)

(AD-683337; AFCRL-68-0356) Avail: CFSTI CSCL 4/1

Techniques for the recording and analysis of phase variations of pulse modulated ground backscatter data are discussed. It is shown that these techniques are capable of yielding additional information about the characteristics of layers of the ionosphere capable of supporting ground backscatter. The formation and motion of ionospheric irregularities of electron density are easily determined by these techniques. An effort was made to determine whether or not it is possible to detect any difference between land and sea slant backscatter. It was found that at the high frequencies (8 to 64 mHz) used in the experiment the solar control effect on the F-2 layer in the directions from 90 degrees to 180 degrees to 270 degrees was very much larger than the possible difference between land and sea backscatter that it rendered impractical the detection of this difference. Author (TAB)

N69-27195# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.

PULSE SOUNDING WITH CLOSELY SPACED RECEIVERS AS A TOOL FOR MEASURING ATMOSPHERIC MOTIONS AND FINE STRUCTURE IN THE IONOSPHERE

W. Pfister and K. Bibl (Lowell Technol. Inst. Res. Found., Mass.) Dec. 1968 30 p refs

(AD-683240; AFCRL-68-0662; ERP-295) Avail: CFSTI CSCL 4/1

The objectives as well as the details of the conventional type of correlation analysis are critically examined and deficiencies are pointed out with suggestions for possible improvement. A new technique for measuring amplitude and phase fluctuations is then described, preliminary results are presented and the advantage of combining amplitude and phase information is emphasized. Author (TAB)

N69-27248*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A TECHNIQUE TO INFER ATMOSPHERIC WATER-VAPOR MIXING RATIO FROM MEASURED HORIZON RADIANCE PROFILES

Thomas B. Mc Kee, Ruth I. Whitman, and Jules J. Lambiotte, Jr. Washington Jun. 1969 36 p refs

(NASA-TN-D-5252) Avail: CFSTI CSCL 08H

A technique is presented to infer atmospheric water-vapor mixing-ratio structure from measured horizon radiance profiles when a method exists for calculating radiance profiles. The technique was implemented for the spectral interval, 315 cm^{-1} to 475 cm^{-1}, of the rotational water-vapor band but the technique is not limited to that interval. Inferred mixing-ratio accuracy for the 10-km to 35-km altitude range is shown when the computer program input data contain no errors and when the computer program input is perturbed by errors normally found in measurements. Water-vapor mixing ratios were inferred from horizon radiance profiles measured in the summer in a latitude range from 17° North to 58° North from an NASA Project Scanner flight. No significant latitudinal variation existed above an altitude of 18 km. Below 18 km a latitudinal variation does exist that is consistent with the large variations that are known to exist in the troposphere. The mixing ratio decreases with altitude to a minimum at a point ranging from 3 km to 5 km above the tropopause altitude. Above an altitude of 20 km the mixing ratio shows a slight increase to 35 km. Author

N69-27311# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Western Div.

THE DOUGLAS GEOPHYSICAL OBSERVATORY PROGRAM

J. M. McDonough Dec. 1968 20 p refs

(AD-683877; DAC-62439; PR-7) Avail: CFSTI CSCL 3/1

The Geophysical Observatory Program began in 1961 with plans for an antarctic station. This station began operation in February 1962 at McMurdo Sound, Antarctica (77 deg 51 min S, 166 deg 43 min E, geographic), and has operated continuously since that time. The objectives of the program are: (1) To determine the frequency of occurrence and intensity-time profiles of solar cosmic ray events. (2) To investigate the effects of solar cosmic radiation on the ionosphere. Author (TAB)

N69-27396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF THE PARAMETERS OF A COMPRESSION WAVE IN ROCKY GROUND

B. D. Kristoforov et al 10 Sep. 1968 12 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 3, no. 1, 1967 p 137–142

(AD-683191; FTD-HT-23-696-68) Avail: CFSTI CSCL 19/4

The authors determined the parameters of a compression wave produced by an underground explosion by measuring the time dependence of the pressure in vertical bore holes filled with water. The measurements were made with tourmaline pickups and the signals recorded. Author (TAB)

N69-27401# La Plata Univ. (Argentina).

WIND MEASUREMENTS IN THE TROPOSPHERE AND LOWER STRATOSPHERE [MEDICIONES DE VIENTO EN LA TROPOSFERA Y BAJA ESTRATOSFERA]

H. J. Ricciardi Nov. 1968 41 p refs In SPANISH; ENGLISH summary

(Pub-111) Avail: CFSTI

A review of methods used to measure winds in the troposphere and lower stratosphere is presented. Radiosonde and Rawinsonde methods, the smoke trail system and the tracking of superpressured balloons are considered, with special reference to the different factors affecting the results and an evaluation of errors normally experienced. A final comparison is made of operative and potential methods that can be used in this altitude range. Author

N69-27507*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

REVISED VALUES FOR COEFFICIENTS OF ZONAL SPHERICAL HARMONICS IN THE GEOPOTENTIAL

Yoshihide Kozai 28 Feb. 1969 22 p refs

(Grant NGR-09-015-002)

(SAO-Special-Rept-295) Avail: CFSTI CSCL 08E

From precisely reduced Baker-Nunn observations for 12 artificial satellites with inclinations between 28° and 96°, coefficients of zonal spherical harmonics up to the 21st order in the expression of the gravitational potential of the earth are derived. Author

N69-27508# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE DISTRIBUTION, ATMOSPHERIC TRANSFER, AND ASSESSMENT OF Kr-85 [DISTRIBUTION, TRANSFERT ATMOSPHERIQUE ET BILAN DU KRYPTON-85]
Raymond Pannetier (Ph.D. Thesis - Paris Univ., Orsay) 1968 180 p refs In FRENCH
(CEA-R-3591) Avail: AEC Depository Libraries

Techniques for sampling and measuring ^{85}Kr were developed which allowed the determination of its geographic distribution. From its use as a tracer, an evaluation of the air masses which cross the subtropical fronts as derived, and the stratospheric character of air pollution by ^{85}Kr at the level of the Antarctic soil was evaluated. Levels of ^{85}Kr seem to point to an underestimation of the assessment of nuclear explosion fission energies as adopted by the United Nations Scientific committee on the effects of atomic radiation and emphasize the need to set limits as soon as possible on the amounts of ^{85}Kr released to the atmosphere by fuel-processing plants. Author (NSA)

N69-27514# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
STUDIES IN MARINE GEOPHYSICS AND UNDERWATER SOUND FROM DRIFTING ICE STATIONS Semiannual Technical Summary Report, 1 Jul.–31 Dec. 1968
[1968] 12 p refs
(Contract Nonr-266(82); ARPA Order 218-61)
(AD-682987) Avail: CFSTI CSCL 20/1

Contents: Operations at Fletcher's Ice Island (T-3) and work at Lamont; Bathymetry; Gravity; Magnetics; Seismic profiler; Hydrographic work; Ocean temperature; Tiltmeter; Seismic investigations: Scattering layers; Ocean currents; Long-range sound propagation; Marine geophysical data analysis; Navigation. TAB

N69-27533# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICAL PRINCIPLES AND TECHNICAL MEANS OF AERIAL SURVEYING. CHAPTERS 4 AND 5
A. I. Vinogradova et al 18 Oct. 1968 135 p refs Transl. into ENGLISH of the book "Fizicheskie Osnovy i Tekhnicheskie Sredstva Aerometodov" Leningrad, Izd. Nauka, 1967 p 72–147
(AD-683582; FTD-MT-24-316-68) Avail: CFSTI CSCL 8/2

The book deals with the physical principles and technical means of various aerial surveying methods. It presents the fundamentals of aerial photography, photogrammetry, aerial photo-interpretation, aerial geophysical, and other methods. Modern equipment (Soviet and non-Soviet) used in aerial photography and aerial geophysical surveying is described. The greatest attention has been paid to aerial photographic surveying because of its increasing importance among aerial surveying methods. This book is divided into three parts covering aerial photography, photograph processing and photograph analysis, each of which is analyzed separately with respect to methods, equipment and theoretical fundamentals. Geophysicists, aerial surveyors, and specialists working in allied fields should find this work useful. Author (TAB)

N69-27535# Joint Publications Research Service, Washington, D.C.
STUDIES ON THE TSUNAMI WAVE
2 May 1969 54 p refs Transl. into ENGLISH of the book "Problems Tsunami" Moscow, Nauk, 1968 p 51-74, 105-120, 133-140
Avail: CFSTI

CONTENTS:

1. RELATIONSHIP BETWEEN A TSUNAMI WAVE AND THE BURIED SOURCE GENERATING IT G. S. Podyapolskiy p 1-14 (See N69-27536 14-13)

2. APPLICATION OF RECOGNITION THEORY METHODS FOR THE STATISTICAL SEPARATION OF SHALLOW AND DEEP EARTHQUAKES FROM DYNAMIC CHARACTERISTICS OF RECORDS I. L. Nersesov et al p 15-27 refs (See N69-27537 14-13)

3. PATTERNS OF ORIENTATION OF MOVEMENT DURING KURILE-KAMCHATKA EARTHQUAKES AND POSSIBILITY OF TSUNAMI ZONING V. N. Aver'yanova p 28-45 refs (See N69-27538 14-13)

4. DETERMINING SOME PARAMETERS OF THE FOCUS OF THE TSUNAMI-GENERATING EARHQUAKE OF 13 OCTOBER 1963 FROM LONG-PERIOD RAYLEIGH WAVES O. Ye. Starovoyt p 46-54 refs (See N69-27539 14-13)

N69-27536# Joint Publications Research Service, Washington, D.C.
RELATIONSHIP BETWEEN A TSUNAMI WAVE AND THE BURIED SOURCE GENERATING IT
G. S. Podyspolskiy *In its* Studies on the Tsunami Wave 2 May 1969 p 1-14 (See N69-27535 14-13)
Avail: CFSTI

Two of the three fundamental stages in the life of a tsunami wave, development during a seismic tremor and propagation over great distances through the deep ocean, are analyzed. Taking into account the role of gravitational forces and the elastic properties of the water and the underlying rock, the phenomenon is examined in a linear approximation. The mathematical problem of determining the developing dynamic displacement field is formulated; the superposition of plane waves leads to a precise solution in the form of corresponding integrals describing the forming displacement. The tsunami wave, propagating for enormous distances, is contained in the solution as a wave of the resonance type. P.A.B.

N69-27537# Joint Publications Research Service, Washington, D.C.
APPLICATION OF RECOGNITION THEORY METHODS FOR THE STATISTICAL SEPARATION OF SHALLOW AND DEEP EARTHQUAKES FROM DYNAMIC CHARACTERISTICS OF RECORDS
I. L. Nersesov et al *In its* Studies on Tsunami Wave 2 May 1969 p 15-27 (See N69-27535 14-13) refs
Avail: CFSTI

Four recognition methods are described and illustrated: (1) the product of one dimensional probability densities, (2) linear criterion (discriminatory analysis), (3) evaluation of multidimensional probability densities using the potentials method, and (4) linear prediction of unknown parameter. The first three methods were applied to recognition of deep and shallow earthquakes in Central Asia on the basis of the dynamic characteristics of the record of oscillations. A method for predicting the depth of an earthquake is also described. P.A.B.

N69-27538# Joint Publications Research Service, Washington, D.C.
PATTERNS OF ORIENTATION OF MOVEMENT DURING KURILE-KAMCHATKA EARTHQUAKES AND POSSIBILITY OF TSUNAMI ZONING
V. N. Averyanova *In its* Studies on the Tsunami Wave 2 May 1969 p 28–45 refs (See N69-27535 14-13)
Avail: CFSTI

An attempt is made to zone the Kurile-Kamchatka seismically active area on the basis of a statistical analysis of data on seismic activity and the direction of movements in earthquake foci. Using frequency curves and the mean rate of a accumulation of relative stresses, the frequency of occurence of the strongest earthquakes in each sector of the zone is determined. Data on the directions of first movements in earthquake foci are analyzed, considering predominant types of dislocations and spatial distributions of

dislocations. A map of regionalization of the zone is compiled in relation to genesis of tsunamis. The reliability of the data on the frequency of repetition of strong earthquakes in individual sectors of the zone is then checked by a comparative analysis with all available data. P.A.B.

N69-27530# Joint Publications Research Service, Washington, D.C.
DETERMINING SOME PARAMETERS OF THE FOCUS OF THE TSUNAMI-GENERATING EARTHQUAKE OF 13 OCTOBER 1963 FROM LONG-PERIOD RAYLEIGH WAVES
O. Ye. Starovoyt *In its* Studies on the Tsunami Wave 2 May 1969 p 46-54 refs (See N69-27535 14-13)
Avail: CFSTI

Data on the length of the rupture of rock continuity, the rate of its formation, and its orientation are presented, based on the long-period Rayleigh waves registered during the tsunami-generating earthquake in the region of the Kurile Islands on 13 October 1963. The focal parameters are determined by comparing the observed directivity function with the theoretical computed one. Parts of seismograms showing Rayleigh waves obtained using a long-period vertical seismograph of the Press-Ewing type are presented. Computations of the absorption coefficient, phase velocity, and directivity function were made using the amplitude and phase spectra of these waves. P.A.B.

N69-27541# Institute of Geological Sciences, London (England).
HARTLAND OBSERVATORY MAGNETIC RESULTS, 1965–1967
1969 181 p Its Geomagnetic Bul. No. 1
Avail: CFSTI; Nat. Environ. Res. Council £1 10s

Tabulated data are presented on recorded magnetic results of hourly values, daily means and sums of declination West, horizontal intensity, and vertical intensity; diurnal inequalities of the geomagnetic elements; and k indices from the Hartland observatory. The instruments used were the declinometer with collimating magnet and theodolite (D), Schuster-Smith coil magnetometer (H), and dye coil magnet (Z). The scale values of the normal run recorders were determined using Helmholtz coils. For D and H the imposed fields were approximately ± 155 gammas and ± 385 gammas. On each occasion the scale values obtained from the two pairs of observations agreed within about one per cent. For Z, where the scale value was known to be nonlinear, three additional pairs of field values were used: ± 256 gammas, ± 538 gammas, and ± 768 gammas. An empirical relationship based on these observations was used for the conversion of the Z ordinates from millimeters into gammas. B.P.

N69-27578# Institut d'Aeronomie Spatiale de Belgique, Brussels.
AERONOMICAL PHENOMENA IN CONNECTION WITH THE MOON JOURNEY OF APOLLO 8 [AERONOMISCHE VERSCHIJNSELEN VERBAND HOUDEND MET DE MAANREIS VAN APOLLO 8]
E. Aerts and J. Vercheval 1969 15 p refs In FLEMISH; ENGLISH summary *Its* Aeronomica Acta A - No. 60, 1969
Avail: CFSTI

The accounts of various observers are examined in order to explain two aeronomical phenomena observed in Belgium during the evening of 21 December 1968 in the constellation Eagle. The first phenomenon was observed around 1700 hrs near the star Altair, at the coordinates right-ascending 19h 40, declination +3°; this was a steadily growing circular area of diffused light, in appearance like the headlights of an automobile in a fog. Observers variously reported this bright spot as having a red or blue tinge. The second phenomenon was observed around 1800 hrs near the star Theta, at the coordinates right-ascending 19h 16, declination +1.2°; this was described as being a bright, fan- or sickle-shaped area with a small bright spot east of its center. Both phenomena are attributed to the Apollo 8 moon journey. K.W.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-26156# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
NORTH ATLANTIC DATA COLLECTION INSTRUMENTATION AND PROCESSING
Jules E. Blazej May 1969 54 p
(NA-69-11) Avail: Issuing Activity

The project involved the collection and processing of aircraft positional data of air traffic over the North Atlantic Ocean for the purpose of assessing the navigational accuracy of this traffic. The concept, specifications, and broad systems design of the Automatic Beacon/Loran Digitizer System (processor) were developed. The processor was part of a data collection system that also included ancillary antenna and radar beacon systems and Loran navigation systems. Data collection system installations were made at Gander, Newfoundland, Kilkee, Ireland, and on three United States Coast Guard cutters stationed at various locations in the North Atlantic Ocean. The radar data collection program, conducted over a period of 6-1/2 months. The technical and operational approaches to the data collection and processing requirements were generally sound. Author

N69-26161# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC TUNING OF MAGNETIC MASS SPECTROMETERS TO THE MAXIMUM PEAK VALUE OF IONIC CURRENT WITH THE AID OF AN EXTREME REGULATOR
A. A. Volkov et al 5 Nov. 1968 23 p refs Transl. into ENGLISH from Pribory Sist. Avtomat. (Kharkov), no. 5, 1967 p 28–38
(AD-683987; FTD-MT-24-359-68) Avail: CFSTI CSCL 14/2

An extremum automatic control system was developed for maintaining the ion current in mass spectrometers at its peak value. The value of the ion current is related to the trajectory of the ion motion. The peak value occurs when the ion beam is centered on the entrance slit of the ion collector; any drift away from this position decreases the current. The ion current is a function of the accelerating potential, I = f(U). In this system, the current is regulated by an incremental servosystem operating in accordance with extremum control characteristics. The control characteristics of the system are analyzed, a block diagram and a schematic diagram are included. The function of the system is explained. Other systems are mentioned briefly. The control system was successfully operated in laboratory and industrial condition. TAB

N69-26162# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC MAINTENANCE OF LINEAR OVERLAP IN AERIAL PHOTOGRAPHS
I. V. Almazov 18 Sep. 1968 13 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 4, 1967 p 42–48
(AD-683086; FTD-HT-23-590-68) Avail: CFSTI CSCL 14/5

An automatic master apparatus (AMA), controlling the maintenance of linear overlap was developed. The operation of the apparatus is based on the calculation of W/H, where W is the ground speed of the aircraft and H is the true altitude at which photographs are taken; the information obtained from a Doppler

aircraft ground speed meter and new types of radar altimeters. The AMA has been tested by taking aerial photographs of flat as well as of mountainous areas from altitudes from 500 to 5000m using cameras with f sub k = 100 and 200 mm. The linear overlap of the aerial photographs of flat areas was 60 or 80%; and of mountainous areas, 64%. The error in the overlap determined by the mean square method is plus or minus 1% on plains and plus or minus 2% in the mountainous localities. It is concluded that the use of automatic maintenance of the linear overlap based on autonomous radionavigational systems is most satisfactory. No linear discontinuities have been observed on the series of aerial photographs taken with this equipment. Author (TAB)

N69-26282# Bonn Univ. (West Germany). Inst. of Physical Chemistry.

HIGH INTENSITY UV LIGHT SOURCE WORKING UNDER UHV CONDITIONS

H. D. Breuer and H. Moesta [1968] 7 p refs

Avail: CFSTI

A new high intensity ultraviolet light source, working under ultrahigh vacuum conditions, has been constructed using liquid tin as the exploding fine wire. The liquid metal is propelled by a short pulse of pure nitrogen and the metal condensing on the upper electrode is removed by electron bombardment. The lamp can be used for space simulation experiments and is at present being used to study the change in work function of metal films with an adsorbed gas layer. ESRO

N69-26297# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.

TEMPORAL REFERENCE HOLOGRAPHY

A. F. Metherell Feb. 1969 20 p refs *Its* Res. Commun. No. 92

(AD-683568) Avail: Issuing Activity CSCL 14/5

This paper describes a new form of acoustical and microwave holography which obviates the need for a real or electronically simulated reference wave. The use of linear (rather than square-law) detectors permits recording of the instantaneous non-time-averaged object wave potential within the acoustic or microwave cycle rather than the intensity of the sum of an object wave and a reference wave time-averaged over many cycles. The time at which the recording is made is the reference rather than a real or electronically simulated reference wave. To achieve the effect of a plane reference wave making an angle theta with the hologram plane, it is necessary to record the object wave potential instantaneously along a straight line on the hologram at the same time as the recording line is swept with velocity v across the plane in the direction perpendicular to the line. Then sin theta = a/v, where a is the speed of the acoustic or microwave radiation. The feasibility of this method is demonstrated by recording and reconstructing a 4.8 MHz temporal reference acoustical hologram made with a Sokolov ultrasonic camera system. Author (TAB)

N69-26308# Institut Franco-Allemand de Recherches, St. Louis (France).

EFFECT OF ROCKET VELOCITY ON THE INTERIOR GAS PRESSURE OF AN ONBOARD SPECTROMETER [INFLUENCE DE LA VITESSE DE LA FUSEE SUR LA PRESSION DE GAZ A L'INTERIEUR D'UN SPECTROMETRE EMBARQUE]

J. Geerk 20 Nov. 1967 21 p In FRENCH

(T-48/67) Avail: CFSTI

The operational altitude of an ion spectrometer aboard a Veronique rocket is determined. Laboratory experiments have shown that acceptable operating conditions begin with $7 \cdot 10^{-4}$ torr. The altitude at which the interior of the intake orifice reaches this pressure is calculated as a function of rocket velocity. It is concluded that the rocket attains a velocity of 800 m/s at an altitude of 100 km. The pressure at this altitude should not be greater than $3 \cdot 10^{-4}$ torr., taking degassing into account. Transl. by K.W.

N69-26310# Toronto Univ. (Ontario). Dept. of Physics.

STIMULATED RAMAN EMISSION AND ABSORPTION SPECTROSCOPY. INTENSITY AND GAIN MEASUREMENTS OF THE STIMULATED RAMAN EMISSION IN LIQUID O_2 AND N_2 Semiannual Report, 1 Jun. 1968–1 Jan. 1969

Boris P. Stoicheff, Archibald K. McQuillan, J. Bernard Grun Dec. 1968 34 p refs

(Contract Nonr-5012(00); ARPA Order 306)

(AD-683698; SAR-7) Avail: CFSTI CSCL 7/4

In liquid O2 and N2 the threshold for stimulated Raman emission is found to be much lower than for other nonlinear processes. Thus it is possible to make reliable measurements of the intensity of Raman emission over a large range of incident laser power by using a simple longitudinal geometry. Several distinct regions of emission were investigated, including normal Raman scattering, exponential gain, onset of oscillation and saturation. There is good agreement with theory. Author (TAB)

N69-26321*# Stanford Research Inst., Menlo Park, Calif.

EXPERIMENTAL STUDY OF VISUAL ACCOMMODATION Final Report

H. D. Crane and T. N. Cornsweet Jun. 1968 26 p refs

(Contract NAS2-4322; SRI Proj. 6656)

(NASA-CR-73326) Avail: CFSTI CSCL 14B

A summary report of the third year of a research effort related to the visual accomodation system is presented. The present developmental status of the optometer, visual display unit, and two dimensional eye tracker is briefly described. The first two instruments are currently operational. The eye tracker in its present form has an accuracy on the order of five minutes of arc, still short of the desired accuracy of one to two minutes of arc. Also described are experiments in accommodation control using the optometer and display unit. Author

N69-26356*# Ohio State Univ., Columbus. ElectroScience Lab.

RADAR AND MICROWAVE RADIOMETRIC TECHNIQUES FOR GEOSCIENCE EXPERIMENTS Final Report

W. H. Peake 11 Mar. 1969 17 p refs

(Contract NSR-36-008-027)

(NASA-CR-101124; REPT-1903-10) Avail: CFSTI CSCL 14B

It provides brief descriptions of the equipment developed to measure backscattering cross-sections and brightness temperature of terrestrial surfaces at microwave frequencies, of the measurements made with the equipment, and of the interpretation of the measurements in terms of surface parameters such as dielectric constant and roughness. Techniques for measuring dielectric constant of natural materials at microwave frequencies are described. Author

N69-26372# National Physical Lab., Teddington (England). Aerodynamics Div.

EXPERIENCE IN THE USE OF PRESSURE TRANSDUCERS AND SCANNING SWITCHES FOR ACCURATE MEASUREMENT OF STEADY PRESSURES

G. S. Smith and K. G. Moreton Oct. 1968 21 p refs

(NPL-Aero-Note-1073) Copyright. Avail: CFSTI

The paper describes some of the characteristics of pressure transducers used in wind-tunnel and other experiments in Aerodynamics Division NPL. Consideration is given to the measures necessary to realise the best possible performance from transducers used in conjunction with automatic data recording equipment. The use of pressure scanning switches is discussed, a description of an NPL-designed switch is given and the major factors affecting

its performance are considered. A brief assessment, based on experimental results, of the accuracy of transducer systems is included. Author (ESRO)

N69-26377# Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).
TELESCOPE FOR STUDYING CHARGED PARTICLES PRODUCED BY 14 MeV NEUTRONS [TELESCOPE POUR L'ETUDE DES PARTICULES CHARGEES PRODUITES PAR DES NEUTRONS DE 14 MeV]
Guy Mouilhayrat (Ph.D. Thesis—Paris Univ., 20 Dec. 1967) Feb. 1969 70 p refs In FRENCH; ENGLISH summary
(CEA-R-3624) Avail: CFSTI

A telescope using semiconductor detectors for studying the charged particles produced in a thin radiator by 14 MeV neutrons has been developed. It consists of a proportional CO_2-counter and two cooled semiconductor detectors (one of the $\Delta E/\Delta x$ type, the other of the E type). This low-noise telescope has good energy resolution (370 keV). Used in conjunction with a biparametric recording (ΔE–E) it gives satisfactory identification and discrimination of the charged particles (p,d) detected. This telescope has been used to observe the spectrum of protons from the reaction D(n,p)2n emitted at 0° (E_n = 13.9 MeV) in the energy range 4–14 MeV. Author (ESRO)

N69-26407# ARO, Inc., Arnold Air Force Station, Tenn.
LASER PHOTOGRAPHIC TECHNIQUE FOR DIRECT PHOTOGRAPHY IN AN AEROBALLISTIC RANGE Final Report, Apr.–Jul. 1968
P. H. Dugger and J. W. Hill AEDC Feb. 1969 24 p refs
(Contract F40600-69-C-0001)
(AD-683259; AEDC-TR-68-225) Avail: CFSTI CSCL 14/5

A front-lighted photographic system employing a giant-pulse ruby laser as a light source has been developed and installed in the 1000-ft hypervelocity Range G of the von Karman Gas Dynamics Facility. Preliminary results indicate that this photographic technique provides an excellent method for in-flight examinations of model integrity, surface condition, and for accurate in-flight measurements of model profile dimensions (plus or minus 0.002 in.) and their changes that might be produced by erosion or ablation. Author (TAB)

N69-26413# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
DESCRIPTION OF A MULTI-MODE GAMMA SPECTROMETER [DESCRIPTION D'UN SPECTROMETRE GAMMA MULTIMODE]
Joël Chardine, Gérard Haouat, Claude Humeau, Jean Lachkar, Henri Roquefort et al Feb. 1969 44 p refs In FRENCH; ENGLISH summary
(CEA-R-3747) Avail: CFSTI

A 'multimode' gamma spectrometer known as the 'SGMM 10' has been studied and built. It can detect photons by one of three different modes: total absorption, photoelectric and anti-Compton effect, or the pair effect. These results are recorded in such a way that the experimenter can interpret the measurements according to the mode which is the best adapted to the energy of the photons under study. The instrument consists of a central detector, a Ge(Li) semi-conductor with its cryostat, and an annular crystal, a large volume NaI(Tl) scintillator consisting of four optically isolated sectors. The energy and time data produced by these detectors are processed by an electronic unit. The report gives an overall description of the SGMM 10 type device and its mode of operation; it also details the laboratory results obtained with this apparatus. Author (ESRO)

N69-26432# Stanford Univ., Calif. High Energy Physics Lab.
ELECTRON-INDUCED CASCADE SHOWERS IN WATER AND ALUMINUM
Randy R. Whitney, H. D. Zeman, Carol Jo Crannell, and Hall Crannell Nov. 1968 28 p refs Prepared in cooperation with Catholic Univ.
(Contract Nonr-225(67))
(AD-683704; HEPL-588) Avail: CFSTI CSCL 18/4

In the present experiment, the three-dimensional distribution of energy deposition was measured for 1-GeV electron-induced showers in water and aluminum. For the water target, two different detectors were employed: CsI(Tl) and anthracene. The measured longitudinal distribution of energy in water was found to be essentially independent of the detector employed in the measurement, while the radial distribution of energy deposition shows a strong detector dependence. Data were measured for the aluminum target with a CaF2(Eu) detector. All of these data support the description that the primary energy-deposition mechanism at the initiation of the shower is ionization of the target material and that the principle energy-transport mechanism after shower maximum is the propagation of minimum attenuation gamma-rays. The radial distributions of energy deposition show that the apparent dependence on the atomic number of the target observed in an earlier experiment was in part a detector-dependent result. The radial distributions, nevertheless, show significant differences from the prediction based on the Monte Carlo calculations of Nagel. Author (TAB)

N69-26460# National Physical Lab., Teddington (England). Ship Div.
A STRAIN GAUGE TORSIONMETER FOR SHIP SHAFT SYSTEMS
H. B. Boyle Feb. 1969 30 p refs Prepared jointly with Bristol Siddeley Eng. Ltd., Brit. Ship Res. Assoc., D. Napier and Sons Ltd., Natl. Inst. of Oceanog., and Vosper Ltd.
(NPL-Ship-12) Copyright. Avail: CFSTI

The development of a strain gauge system for measuring the torques on small diameter shafts (4 in) is described. The choice of the measuring transducer and the tranafer of the signal from the rotating shaft to the measuring system are discussed and the calibration of the measuring system is explained. The advantages of the method, as compared with more classical methods, are stressed. ESRO

N69-26468# Bolkow Entwicklungen K. G., Munich (West Germany).
MEASURING INSTRUMENTS AND FLIGHT TESTING OF BO-105 HELICOPTER [MESSINGSTRUMENTIERUNG UND FLUGMESSUNGEN AM HUBSCHRAUBER BO-105]
H. Gloeckl *In* WGLR Helicopter Flight Meas. Aug. 1968 p 51–72 In GERMAN (See N69-26465 14-02)
Avail: CFSTI

Measuring instruments, including a telemetry system, fitted on the BO-105 helicopter prototype are described. The transmission of data by telemetry led to an acceleration of the flight test time and increased the safety of the flights. ESRO

N69-26481# Consiglio Nazionale delle Richerche, Rome (Italy). Istituto Nazionale di Ultracustica O. M. Corbino.
DETERMINATION OF THE INTERNAL THERMAL STATE FOR STEEL INGOTS BY MEANS OF MECHANICAL VIBRATION [DETERMINAZIONE DELLO STATO TERMICO INTERNO DEI LINGOTTI DI ACCIAIO MEDIANTE VIBRAZIONI MECCANICHE]
S. D'Elia and M. Mirabile Dec. 1967 29 p refs In ITALIAN
(INUA-3) Avail: CFSTI

A system for determining the temperature distribution in steel bars is described. By using two electrodes to time the passage of a signal through a segment of the bar the velocity of the signal, and thus the laminar temperature, is determined with

great accuracy. These procedures are used on all types of steel produced at Italsider. Graphs correlating the measurements of velocity versus temperature for several steels are included. Transl. by F.O.S.

N69-26497 Ohio State Univ., Columbus.
LOW TEMPERATURE HEAT CAPACITIES OF α MANGANESE, CESIUM, AND RUBIDIUM
Byron Dale Martin (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-15354

A cryostat capable of obtaining temperatures as low as 0.05°K was designed, constructed, and operated successfully. It was used to measure the heat capacities of α-manganese, cesium, rubidium, and copper down to 0.2°K. The cryostat has a liquid He^4 dewar inside a 77°K liquid nitrogen dewar. The He^4 vapor pressure is reduced by vacuum pumps, reducing the temperature of the liquid He^4 to 1.02°K. The next stage of cooling is a He^3 system capable of reaching 0.3°K. A closed pumping system allows recovery of the He^3 vapor for re-use. The He^3 liquid is contained in a hollow copper block. An evacuable stainless steel cylinder, sealed with an indium O ring, encloses this block, the sample, and a paramagnetic salt pill. The salt, 162 grams of cerium magnesium nitrate, is inside a heliarc welded stainless steel cylinder. Dissert. Abstr.

N69-26509# Stanford Univ., Calif. High Energy Physics Lab.
LINEARITY AND RESOLUTION OF SEMICONDUCTOR RADIATION DETECTORS
H. R. Zulliger, L. M. Middleman, and D. W. Aitken Oct. 1968 33 p refs Presented at the 15th Ann. IEEE Nucl. Sci. Symp., Montreal, Canada, Oct. 1968
(Contracts AF 49(638)-1499; Nonr-225(67))
(AD-683703; HEPL-585) Avail: CFSTI CSCL 18/4

The energy linearity for Si(Li) and Ge(Li) has been measured and compared with theory. Good agreement was obtained for x-ray attenuation factors. The region of the germanium absorption edge was investigated and found to exhibit larger nonlinearities than predicted by the theory. The discrepancy is believed to be due to inefficient charge collection near the detector window leading to excessive fluctuations in the trapped charge. Calculations of the line broadening due to trapping have been shown to agree qualitatively with experimental values for the silicon detector. These calculations do not take into account any position dependent variation of the trapping factor, and must therefore be considered as the best attainable values. The disagreement between theory and experiment for the line broadening in Ge(Li) is particularly evident. TAB

N69-26511# Stanford Univ., Calif. High Energy Physics Lab.
A NaI(T1) TOTAL ABSORPTION DETECTOR FOR ELECTRONS AND GAMMA-RAYS AT GeV ENERGIES
R. Hofstadter, E. B. Hughes, W. L. Lakin, and I. Sick Dec. 1968 15 p refs
(Contract Nonr-225(67))
(AD-683701; HEPL-579) Avail: CFSTI CSCL 18/4

The paper reports a new and successful demonstration of the use of total absorption shower detectors for electrons and gamma-rays in the GeV energy range. Such detectors have the following attractive properties: (a) 100 per cent detection efficiency, (b) good energy resolution and (c) large dynamic range. Moreover, there is virtually no upper limit to the energy detectable by this means because the size of the detector varies only logarithmically with the energy of the incident electron or gamma-ray. Author (TAB)

N69-26549# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
THE VERTICAL DISTRIBUTION OF OZONE BETWEEN 35 AND 55 km AS DETERMINED FROM SATELLITE ULTRAVIOLET MEASUREMENTS
Gail Paterson Anderson (M.S. Thesis) 1969 66 p refs
Avail: Issuing Activity

An Ebert–Fastie ultraviolet spectrometer mounted on a polar-orbiting satellite was used to observe back-scattered radiation in the spectral region 2550 to 3100Å. The data were calibrated using a coordinated rocket sounding to determine the effective solar flux. A modified Phillip–Twomey inversion technique was then applied, yielding a reasonable vertical ozone distribution between 35 and 55 km. Author

N69-26586# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Geo-Astrophysics Section.
PRACTICAL CALIBRATION AND CONTROL TECHNIQUE FOR TYPE 8443 AND EKTACHROME FILMS
W. G. Egan May 1969 37 p refs Presented at Aerial Color Phot. Workshop, Gainesville, Fla., 5–7 Mar. 1969
(RM-443J) Avail: Issuing Activity

For scientific applications using color photography, it is of utmost importance to have a precision monitoring of the overall photographic process including: (1) manufacture and storage of film, (2) exposure, (3) development, and (4) densitometry evaluation. This control is vital in scientific color photography where it was reported that as many as 10,000,000 colors can be recognized by the human eye. Practical calibration techniques are described which may be adapted to the requirements of an aerial color laboratory involved in the evaluation of aerial color photographs. Author

N69-26596# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING THE MEASUREMENT OF DIELECTRIC PROPERTIES OF LIQUIDS WITH GREAT LOSSES
V. V. Levin 4 Oct. 1968 13 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. II: Khim. (Moscow), v. 22, no. 1, 1967 p 23–26
(AD-683535; FTD-MT-24-330-68) Avail: CFSTI CSCL 20/3

The microwave bridge method for measurement of the real (epsilon sub 1) and imaginary (epsilon sub 2) parts of the permittivity of liquids with large losses is described. The method is based on the detn. of the distances at which the output signal of the microwave bridge corresponds to the infinite thickness of the measured liquid. TAB

N69-26670 California Univ., Los Angeles.
ON THE OPTIMUM UTILIZATION OF INERTIAL COMPONENTS
Eugene Chin Hoy (Ph.D. Thesis) 1968 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-16540

To facilitate the obtaining of direct analytical solutions, accuracy criteria and error models are established. The most mathematically tractable forms are selected for the examination of redundant sensors, and the study of the feasibility of trajectory shaping to minimize measurement errors. Numerous specific results of both a quantitative and qualitative nature are developed germane to the optimum utilization of inertial components. The analytical solution to the orthogonal two-dimensional problem is developed. Direct analytical solutions to a tri-lobed azimuthal symmetric configuration are presented. An adaptive, weighted least-squares, redundant-sensor configuration is discussed. Numerical results from an on-line, digital computer program are shown. Feasibility of an idealized bilevel-acceleration trajectory in minimizing measurement errors is examined. A constant-acceleration trajectory is shown to be optimum under certain conditions. Dissert. Abstr.

N69-26721*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
WIND VELOCITY MEASUREMENTS Final Report

30 Nov. 1967 83 p refs
(Contract NAS8-20413)
(NASA-CR-101108; R67-4548) Avail: CFSTI CSCL 14B

Doppler heterodyne detection experiments at 10.6 microns conducted on soft targets out-of-doors verified the feasibility of the technique for a variety of systems applications. The characteristic curves of a copper-doped germanium detector were measured. These curves indicate that a maximum heterodyne current responsivity should occur at high local oscillator power and high bias voltage. Preliminary measurements were carried out on detector noise and coherence areas which will eventually lead to a determination of optimum conditions for a maximum signal-to-noise ratio for heterodyne detection at 10.6 microns. Author

N69-26740# Army Foreign Science and Technology Center, Washington, D.C.
THE ZhTSh THEODOLITE-LEVELING INSTRUMENT
A. F. Lyutts and V. S. Redkov 18 Feb. 1969 13 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 4, 1968 p 31–36
(AD-683482; FSTC-HT-23-718-68) Avail: CFSTI CSCL 17/8

A peculiarity of the design of the ZhTSh theodolite, distinguishing it from the OTSh theodolite, whose basic design was modified, is that the degree graduations on the vertical circle have been replaced by a scale of the tangents of angles of inclination (slopes) to a slope of +0.4 with 0.0) intervals. The following characteristics of the instruments were investigated: telescope magnification, value of graduation on horizontal circle alidade, errors m sub c in constancy of compensator position, errors match in introducing the lines of the vertical circle into the compensator bissector (bisecting error), constant K) of the influence of eccentricity of the vertical circle on the vertical angle measured with the circle in two positions and also the limits of operation of the compensator in the sighting direction. The ZhTSh theodolite-leveling instrument can be used in performing preliminary engineering studies for alignment of railroads and highways under difficult conditions. Author (TAB)

N69-26748# White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.
A GUIDE TO ROCKETSONDE MEASUREMENT OF ATMOSPHERIC OZONE
Jagir S. Randhawa Jan. 1969 28 p refs
(AD-683464; ECOM-5228) Avail: CFSTI CSCL 4/1

The guide describes the preflight instrument preparation and data reduction procedures for the rocket-borne ozonesonde developed by the Atmospheric Sciences Laboratory, White Sands Missile Range. Basic system components are outlined, and the theory of operation is discussed. The ozonesonde is used for the measurement of ozone concentration to within plus or minus ten percent in the mesosphere and stratosphere after deployment from an Arcas rocket vehicle. Author (TAB)

N69-26825# Minnesota Univ., Minneapolis. Dept. of Chemistry.
FLUORESCENCE LIFETIME MEASUREMENTS BY TIME CORRELATED SINGLE PHOTON COUNTING
William R. Ware 1 Mar. 1969 28 p refs
(Contract N00014-67-A-0113)
(AD-683667; TR-3) Avail: CFSTI CSCL 7/5

The report describes the details of a single photon time correlation fluorescence lifetime apparatus. The instrument possesses high sensitivity and resolution, and since there is almost nothing in the literature regarding the details of such instrumentation, it was considered appropriate that the design and performance of this instrument should be described in a technical report. Author (TAB)

N69-26897# Bhabha Atomic Research Centre, Bombay (India). Analytical Div.
STUDY OF IRREVERSIBLE PROCESSES BY POLAROGRAPHY
V. R. Chandrasekharan, R. Sundaresan, S. C. Saraiya, and T. P. Radhakrishnan 1968 25 p refs
(BARC-370) Avail: CFSTI

Polarography is studied as an important tool for electrode processes in theory and instrumentation. Electrode processes are divided into two classes, reversible and irreversible. A review of irreversible processes is given. Based on a reduction reaction occurring at the dropping mercury electrode, a reversible process is defined, and the Nernst equation applied. The irreversible processes are classified as total or quasi. The kinetic parameters: transfer coefficient, and the standard rate constant, are calculated by several methods. Current-potential curves, and tables are included. F.O.S.

N69-26899 Pittsburgh Univ., Pa.
PHOTOCONDUCTIVE CELLS AS DETECTORS FOR VISIBLE PHOTOMETRY
Michael William Hayes (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-16622

The main disadvantages associated with photoconductive cells were investigated in an attempt to ascertain how seriously these disadvantages would limit the application of photoconductive cells as detectors in photometry. The performance of these detectors in such analytical applications as the determination of absorbance as a function of concentration of an absorbing species were investigated using various photometers. Equations relating absorbance, as determined by a photoconductive cell, to the concentration of the species for both the "ordinary" and "high absorbance" methods of photometry were derived. A comparison of the performances of photoconductive cells with other types of selective radiation detectors was made on the basis of two aspects of analytical importance: (1) the sensitivity of the detectors to changes in radiant energy intensity for a given absorbing species and at a fixed wavelength, and (2) the overall concentration range of this species, for which these detectors could be used. Dissert. Abstr.

N69-26967# Naval Radiological Defense Lab., San Francisco, Calif.
A COMPTON-SUPPRESSED COINCIDENCE GAMMA-RAY SCINTILLATION SPECTROMETER WITH LARGE NaI(Tl) CRYSTALS
Bruce A. Euler, David F. Covell, and Sachio Yamamoto 14 Sep. 1968 57 p refs
(AD-683323; USNRDL-TR-68-150) Avail: CFSTI CSCL 18/4

A Compton-suppressed coincidence gamma-ray scintillation spectrometer has been assembled to obtain high sensitivity and selectivity in gamma-ray spectral measurements. The spectrometer is intended to satisfy requirements for the identification and estimation of low levels of gamma-ray radioactivity in a broad range of sample sizes and masses containing moderately complex mixtures of gamma-emitting radionuclides. Author (TAB)

N69-27159# Tokyo Univ. (Japan). Inst. of Industrial Science.
STUDY ON ELECTROPHOTOGRAPHIC LAYER
Shin-ichi Kikuchi and Toshifumi Sakata Mar. 1969 77 p refs In JAPANESE; ENGLISH summary *Its* Serial No. 121, vol. 18, no. 2
Avail: CFSTI

Discussed are the basic problems of electrophotography using zinc oxide dispersion in a dielectric resin for imaging processes. The characteristics of electrophotographic layers depend on the relation between zinc oxide dispersion density and the developing surface voltage. Also studied are atmospheric effects on surface

potential, surface voltage, and image density of the electrophotographic layer. Electrophotography finds application in the fields of photography, printing, and communications. G.G.

N69-27170# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOGRAMMETRIC EQUIPMENT [APPAREILS POUR LA PHOTOGRAMMETRIE]
29 Oct. 1968 14 p Transl. into ENGLISH from V/O Mashpriborintorg (Moscow) p 1–11
(AD-683546; FTD-HT-23-502-68) Avail: CFSTI CSCL 8/2

The AFA-TE device is used to obtain aerial photographs. The basic components are the camera housing, a magazine, and an auxiliary unit. A KPT-Z remote control device is used with the aerial camera. The main distinction of the unit is that it is powered by electric gears rather than mechanical gears. A number of design innovations have been incorporated into this unit, so that it is capable of providing precise aerial photographs. Author (TAB)

N69-27190# Rome Univ. (Italy). Inst. of Physics.
A CORRELATION TECHNIQUE FOR POWER SPECTRUM MEASUREMENT OF THE INTERPLANETARY MAGNETIC FIELD
S. Cantarano and G. V. Pallottino 28 Nov. 1968 32 p refs Prepared jointly with Consiglio Nazl. delle Ric. /ts Nota Interna 195
Avail: CFSTI

A correlation technique is described which gives a useful reduction of the noise in power spectrum measurements of the interplanetary magnetic field by means of the search coil technique. Two sensors that detect the same signal are required. If the noises of the two amplifying channels are uncorrelated, the time-average of the product of the two channel output depends on the power of the magnetic field signal, but is not affected by the noises of the two channels. Preliminary experimental results are given, showing that an improvement factor equal to 5 ÷ 10 was obtained. The applications of the proposed technique to spaceborne instrumentation leads to a relevant reduction in weight and bulk because of the lower sensitivity required from the sensor. Author (ESRO)

N69-27215# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
ULTRASONIC CHANNEL MEASURING SYSTEM
A. E. Arave Jan. 1969 9 p refs
(Contract AT(10-1)-205)
(IDO-17290)

To measure the ETR and ATR fuel elements in a canal after being removed from a reactor an ultrasonic system was used. It has an accuracy of 0.5 mil, a resolution of 0.1 mil, and a range from 50 to 175 mils. The heart of the system is a probe holding two 8-MHz, 10-mil-thick lead zirconate titanate piezoelectric crystals. Distance between channel walls is obtained by measuring the time for an 8-MHz sound burst to travel between the crystals which are held next to the walls. The signal received by one crystal, transmitted from the other crystal, is used as a trigger for a time-to-analog converter that is connected to the "Y" axis of a recorder. Longitudinal distance in the channel is converted to an analog output to drive the "X" axis of the same recorder. Author (NSA)

N69-27236# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
ULTRASONIC ANEMOMETER FOR MEASURING STEAM CONVECTION CURRENTS
A. E. Arave Jan. 1969 12 p refs
(Contract AT(10-1)-205)
(IDO-17293) Avail: CFSTI

An ultrasonic anemometer has been developed to measure airsteam mixture convection currents in reactor containment shells for AEC reactor safety programs. This anemometer was built specifically for the Loss of Fluid Test, LOFT, at the National Reactor Testing Station, NRTS. The detector is developed for high humidity, 130°C environment but can be used for measuring flow in many other gas conditions. It has an analog output proportional to velocity and speed of sound which can be used in the ultrasonic anemometer equation to find velocity and speed of sound. Author (NSA)

N69-27239# Oak Ridge National Lab., Tenn.
PULSE CALORIMETRY USING A DIGITAL VOLTMETER FOR TRANSIENT DATA ACQUISITION
T. G. Kollie, D. L. McElroy, M. Barisoni and C. R. Brooks Feb. 1969 33 p refs
(Contract W-7405-eng-26)
(ORNL-4380) Avail: CFSTI

A pulse calorimeter for measuring the specific heat of electrical conductors from 300 to 1500°K is described. The technique employed is unique in that a digital voltmeter, which is capable of recording 2000 readings/sec to a readability of 0.01% of full scale, is utilized to measure the transient temperature and power signals requisite to the method. Using this technique a calculated determinate accuracy of 99% has been achieved to 1200°K. Above 1200°K, the accuracy is at least 98%. Measurements of the specific heat of pure iron from 300 to 1500°K were repeatable to within ±0.5% and confirmed the above accuracy statements. The calorimeter is capable of measuring the specific heat and electrical resistivity rapidly at temperature intervals as small as 0.03 degree, and the significance of such capability is discussed, particularly with regard to the nature of the specific heat of iron near its Curie transformation. Author (NSA)

N69-27244 Cornell Univ., Ithaca, N.Y.
ORBITAL PHOTOGRAMMERTY: A THEORETICAL STUDY OF AUXILIARY DATA APPLICATION
Robert Barlow McEwen (Ph.D. Thesis) 1968 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-15729

Photogrammetric application of earth orbiting sensors is studied. In particular the use of auxiliary data is examined to solve the problems of determining sensor position and orientation at the instant of exposure. While many orbiting sensors would have the frame format of a photographic camera, the discussion is not restricted to this case alone. Position and orientation would be essential parts of the exterior orientation of any sensor. Some of the terminology and concepts of orbital systems are introduced. The operational principles of several existing tracking systems and the characteristics of horizon scanning attitude systems are described. Satellite tracking and orbit prediction can provide sensor position in a celestial coordinate system. An error analysis study, using the parameters of Nimbus I, illustrates the rapid accumulation of position error over several days. The results of several combinations of parameter error are presented. Dissert. Abstr.

N69-27247# Academy of Sciences (USSR), Moscow. Institut Fiziki.
LONG-WAVE PETURBATIONS OF STELLARATOR MAGNETIC SYSTEM GEOMETRY
I. S. Daniikin 1968 48 p refs in RUSSIAN
(NP-17779) Avail: AEC Depository Libraries

Long-wave perturbations of geometric parameters in a stellarator magnetic system were studied so that the most critical geometric distortions might be revealed. Comparisons of effective

amplitudes of these perturbations revealed, in particular, that geometric nonaxiality of the conducting systems producing longitudinal and helical fields belongs to the group of such critical perturbations. In such a case, the basic resonance in the preaxial region may induce shifting of the magnetic axis system of the aperture arrangement of a vacuum chamber ~0.1 R_0 at the nonaxiality magnitude ~ 10^{-3} R_0, which in turn would demand precision adjustments or a special system for compensation of such possible field perturbations. Author (NSA)

N69-27258# Denver Univ., Colo. Dept. of Physics.
THE PRECISE CALIBRATION OF NORMAL INCIDENCE PYRHELIOMETERS FOR STRATOSPHERIC SOLAR CONSTANT MEASUREMENT
John J. Kosters, Paul R. Gast, and David G. Murcray Sep. 1968 29 p ref
(Contract AF 19(628)-4177)
(AD-683333; SR-2; AFCRL-68-0657) Avail: CFSTI CSCL 4/2

The factors affecting the sensitivity and hence the calibration of Eppley Normal Incidence Pyrheliometers are discussed. A method for controlling these factors in a design suitable for balloon flight is described. Using these techniques ground calibration procedures are described. Data obtained during the ground calibration are presented. Analyses of these data indicate that it is possible to calibrate these units against an Eppley Angstrom pyrheliometer with an accuracy of plus or minus 0.05% if one performs the calibration from a high altitude site on days when the atmospheric conditions are proper. These calibrations employ the same measurement system that will be used for a series of balloon flights; hence the calibration accuracy should be maintained during such a flight. Author (TAB)

N69-27259# Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
THE SHAPE OF TWO-DIMENSIONAL TURBULENT WAKES IN DENSITY-STRATIFIED FLUIDS Final Report
Roy Hayden Monroe, Jr. and C. C. Mei Jun. 1968 85 p refs
(Contract Nonr-1841(59))
(AD-683329; Rept-110; T68-4) Avail: CFSTI CSCL 20/4

The results of an analytical and experimental investigation of the rate of growth of the zone of turbulent mixing behind a two-dimensional circular cylinder are presented. The analytical phase of the study formulated a dynamical model for a parcel of fluid subjected to inertia, turbulent damping, and gravity restoring forces. The experiments were conducted in a tank 120 in. long and 4.5 in. wide which was filled to a depth of 18 in. with a fluid having a linear density gradient. The cylinder was towed at mid-depth by a variable speed motor-pulley system. A record of wake growth behind the cylinder was made by means of motion pictures of an aluminum pigment tracer in the fluid. The Reynolds number ranged from 1300 to 3500 and densimetric Froude numbers varied from 5 to 20. The density stratification was found to exert a strong inhibiting force on the wake growth. Using the dynamical model to correlate experimental data, the mixing length in the turbulent zone was found to decrease with increasing density stratification. Author (TAB)

N69-27264# Phaostron Instrument and Electric Co., South Pasadena, Calif.
ONE PERCENT ACCURACY, 40 AND 100 MICROAMPERE RUGGEDIZED TAUT BAND PANEL METERS 5-1/2" × 4-1/2" Quarterly Development Report, 1 Nov. 1968–31 Jan. 1969
Norman Logan 28 Feb. 1969 26 p ref
(Contract N00024-67-C-1190)
(AD-683344; QR-5) Avail: CFSTI CSCL 14/2

R. F. I. testing over the range 0.15 MHz to 3000 MHz showed the meters were not susceptable to these frequencies and were not significant radiators from an induced signal when the window was screened with .002 inch nickel mesh. Shielding attenuation was low at the low frequencies. Further temperature tests indicated the need to compensate for current change of the meters in addition to the resistance change when they are checked as voltmeters at the designated temperature levels. Author (TAB)

N69-27267*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
COMPILATION OF DATA FROM RELATED TECHNOLOGIES IN THE DEVELOPMENT OF AN OPTICAL PILOT WARNING INDICATOR SYSTEM
Roy Paananen, Keith Gunn, Sejfi Protopapa, Robert Ryan and Ann Story Washington May 1969 101 p refs
(NASA-TN-D-5174) Avail: CFSTI CSCL 01D

The results of analytical efforts on some of the major scientific and engineering aspects of a proposed optical pilot warning indicator are reported. No fundamental obstacles, including projections for its ultimate economic acceptance, appear to stand in the way of early synthesis of prototype xenon lamp silicon detector systems for field tests. Certain system variations look promising for future growth. Author

N69-27275# Air Force Cambridge Research Labs., Bedford, Mass.
SPACE VEHICLE ATTITUDE STUDIES
Charles D. Howard, Daphne J. Innes, and Dolan Mansir Nov. 1968 20 p refs *Its* Instrumentation Papers No. 153
(AD-683860; AFCRL-68-0610) Avail: CFSTI CSCL 19/7

The development of new instrumentation and associated data reduction programs for measuring the orientation attitude of spin-stabilized sounding rockets or satellites has provided a simple low-cost system that is accurate to within 2 deg. The instrumentation has been successfully flown in one satellite and in more than 20 sounding rockets. This paper describes the system performance obtained on two of the sounding rocket flights. Author (TAB)

N69-27281# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
AN IRRADIATION FACILITY FOR IN-PILE MEASUREMENTS OF ELECTRICAL RESISTIVITY AT HIGHER TEMPERATURES UNDER VARIOUS NEUTRON FLUXES FOR OPTIONAL PERIODS
E. Lang and W. Schuele 1968 46 p refs
(EUR-U196.e) Avail: AEC Depository Libraries

An irradiation facility at Ispra-1 reactor for in-pile measurements of electric resistivity of fissile and nonfissile material is described. Encapsulated samples can be irradiated at temperatures between 40° and 1000°C at positions of different neutron fluxes for optional periods. Insertion and extraction of capsules can be performed without shutting down the reactor. Shielding calculations are included. Neutron flux and distribution in the facility were measured. Operating experience and experiments with brass are reported. Author (NSA)

N69-27290# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
UNION CARBIDE DUAL-HEAD INSPECTION POST PROCESSOR
W. V. Schellinger 19 Feb. 1969 176 p
(Contract W-7405-ENG-26)
(K-1722) Avail: CFSTI

The Union Carbide Dual-Head Inspection Post Processor is a special purpose post processor that produces command tapes and/or listings for numerically controlled inspection machines with more than one inspection gage. It has a foundation which allows similar types of inspection machines to be added with a minimum amount of effort. Author (NSA)

N69-27324# Oak Ridge National Lab., Tenn.
INSTRUMENTATION AND CONTROLS DIVISION Annual Progress Report for Period Ending 1 Sep. 1968
G. S. Sadowski, ed., comp. Feb. 1969 126 p refs
(Contract W-7405-eng-26)
(ORNL-4335) Avail: CFSTI

Progress is reported in research and development in instrumentation and controls. Specific topics covered include: (1) nanosecond circuitry and techniques; (2) pulse counting and analysis; (3) biomedical instrumentation; (4) radiation detectors; (5) automatic control and data acquisition; (6) data collection and analysis; (7) process instrumentation and control systems engineering; (8) reactor instrumentation and controls; (9) high voltage accelerator instrumentation; and (10) maintenance and service. K.R.G.

N69-27329# Stanford Univ., Calif. High Energy Physics Lab.
HIGH RESOLUTION WITH NONDISPERSIVE X-RAY SPECTROMETERS
D. W. Aitken Jul. 1968 23 p refs
(Contract AF 49(638)-1499)
(AD-683706; HEPL-560 Avail: CFSTI CSCL 18/4

A research effort was carried out with the aim of acquiring a better understanding of the processes leading to the detection of x rays in silicon and germanium, as well as in alkali halide scintillation crystals. Results of this research, as well as of the work of other groups, now enables one to make a comparison of detectors for high resolution nondispersive x-ray analysis, and to draw some conclusions concerning what to expect in the future. The present article is limited to a discussion of resolution in the x-ray energy region. This region spans the energy range from about 1 keV to 100 keV. This in turn corresponds to the wavelength region extending from about 10 Angstroms down to about 0.1 Angstroms. TAB

N69-27403# Environmental Research Corp., Alexandria, Va.
APPLICATION OF NON-STATIONARY PROCESSES TO GENERATE SYNTHETIC SEISMOGRAMS
Paul R. Beaudet, Walter W. Hays, Robert D. Lynch and Spencer Williams 19 Dec. 1968 47 p refs
(Contract AT(29-2)-1163)
(NVO-1163-156) Avail: CFSTI

The concept and design of a time-varying analog filter for generating synthetic seismograms which approximate real seismograms observed from underground nuclear explosions is given. The basic design of this filter exploits a non-stationary characteristic commonly observed on seismograms; i.e., the progressive transformation with time from relatively high frequency ground motion in the P and S wave windows to the relatively low frequency ground motion in the surface wave window of the seismogram. The response of the filter is a member of an ensemble of synthetic particle velocity seismograms representative of a specified yield and source–station site distance. Comparison of spectra generated from a synthetic seismogram to spectra generated from an observed seismogram having equivalent yield, recording station distance, and station site geology parameters indicates that the synthetic seismograms generated with the time varying analog filter are reasonably close approximations to real seismograms having equivalent parameters. Author (NSA)

N69-27415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATIONS OF INFRARED TECHNIQUES IN MODERN AVIATION
Kung-hsun Shen 11 Sep. 1968 12 p Transl. into ENGLISH from Hang Kung Chin Shih (Communist China), no. 7, 1960 p 10–12
(AD-683143; FTD-HT-23-473-68) Avail: CFSTI CSCL 17/7

The author relates the application of infrared technology in guided missiles control guidance system, its use as aiming devices, in photographing the earth from artificial earth satellites, in detecting remote rockets, etc. Due to its many particular and superior characteristics, as well as certain advantages over radar, it is anticipated more extensive applications in aviation can be foreseen in the near future. Author (TAB)

N69-27423*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CYROGENIC APPARATUS FOR MEASURING THE INTENSITY OF MAGNETIC FIELDS
John Dimeff, inventor (to NASA) Issued 8 Apr. 1969 (Filed 1 Jul. 1965) 5 p Cl. 324–43
(NASA-Case-XAC-2407; US-Patent-3,437,919; US-Patent-Appl-SN-469013) Avail: US Patent Office CSCL 17F

A cryogenic magnetometer is disclosed which has a sensing coil positioned between two sheets of superconductive material. The temperature of the sheets is periodically changed above and below the transition temperature of the sheets so that a magnetic field under test is periodically gated. The effects of residual magnetism in the coil core are obviated because the residual field is not gated. The unknown field passing through the sheets is pinched during the gating process increasing the flux density at the coil, and the amplitude of the resultant signal.
Official Gazette of the U.S. Patent Office

N69-27431*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL FEED-THROUGH CONNECTION FOR PRINTED CIRCUIT BOARDS AND PRINTED CABLE
James F. Blanche, inventor (to NASA) Issued 25 Feb. 1969 (Filed 27 Apr. 1967) 6 p Cl. 339–17
(NASA-Case-XMF-1483; US-Patent-3,430,182; US-Patent-Appl-SN-635325) Avail: US Patent Office CSCL 14B

An electrical feedthrough connection is described for use with pressurized or evacuated equipment containers. The feedthrough has a plurality of conducting elements which are mounted flush in an insulating material surrounded by a frame. The frame is fastened into the wall of the equipment container. Additional strength is given to the structure by shaping the conducting elements and the inside of the frame in irregular configurations so that the insulating material will form a secure bond at the time of molding. External pressure connectors are fastened to the feedthrough by bolts or studs which fit in the tapped holes. The pressure connectors enable printed circuit boards or printed cables to be easily connected to the feedthrough. Official Gazette of the U.S. Patent Office

N69-27432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCANNING ASPECT SENSOR EMPLOYING AN APERTURED DISC AND A COMMUTATOR
Bruce R. Pincus, inventor (to NASA) Issued 18 Mar. 1969 (Filed 31 Mar. 1967) 5 p Cl. 250–203
(NASA-Case-XGS-8266; US-Patent-3,433,961; US-Patent-Appl-SN-628248) Avail: US Patent Office CSCL 20F

A device is described for determining its aspect angle with respect to a radiating body. It has been flown on a Nike Tomahawk sounding rocket with successful results, and will be flown on an Aerobee 150 attitude controlled rocket to determine the point accuracy of the control system with respect to the sun. The device includes a rotatable apertured member with a single radiation sensitive means behind the aperture for receiving radiation from a radiating body. The rotatable member is driven through a speed reducing means by a motor which also drives a commutator ring. A plurality of commutator segments direct voltage pulses to a counting and detecting circuit. When radiation from a body strikes the sensor, its resistance is greatly decreased and the input to the detecting and counting circuit is reduced to a sufficiently low level

that a trigger circuit causes the main counter to be read out into a computer. This count represents the amount of rotation of the disc from the time the synchronizing pulse is generated until the time the body's radiation strikes the sensor. Hence, the counter's output represents the disc's instantaneous position or aspect angle at the time the radiation sensor is subjected to the body's radiation. NASA

N69-27459*# McDonnell Aircraft Corp., St. Louis, Mo.
HEAT FLUX SENSOR ASSEMBLY
Gerald P. Robinson, inventor (to NASA) and Duane E. Crofts, inventor (to NASA) Issued 4 Mar. 1969 (Filed 27 Nov. 1967) 5 p Cl. 136–213
(NASA-Case-XMS-05909-1; US-Patent-3,431,149; US-Patent-Appl-SN-685764) Avail: US Patent Office CSCL 14B

A heat flux sensor is described which consists of a high thermal conductivity sensing disc, a radiation shield, radiator fin, and a housing cup. These elements are nested together coaxially with the radiation shield positioned between the sensing disc and the housing cup. Thermally nonconductive strands of thread are woven radially outward from the peripheral rim of the sensing disc, through the radiator section, to the lip of the housing cup to secure the three elements together in their respective positions without physical contact between them. The design of this sensor was such, so as to substantially isolate the detecting element from undesirable thermal sources by providing a radiation shield between the housing member and the detecting element. A further consideration was to minimize heat conductive physical contact between adjacent heat flux sensor components. NASA

N69-27461*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTROMAGNETIC MIRROR DRIVE SYSTEM
Norman M. Hatcher, inventor (to NASA), Nelson J. Groom, inventor (to NASA) and Arthur L. Newcomb, Jr., inventor (to NASA) Issued 8 Apr. 1969 (Filed 26 Jul. 1966) 5 p Cl. 350–6
(NASA-Case-XLA-3724; US-Patent-3,437,394; US-Patent-Appl-SN-568071) Avail: US Patent Office CSCL 20F

A device for scanning a horizon with a pair of mirrors is described. The two mirrors scan in the same plane but in different directions. Each of the mirrors has a gear attached to its back and the two gears are meshed together. Electromagnetic means are provided for imparting an oscillatory rotation to one of the mirrors. Hence, this oscillatory rotation is imparted to the other mirror through the two gears. This device has numerous advantages over similar mirror drive devices. It is smaller in volume, it is lighter in weight, it requires less electrical power, and it does not have rotor bearings or moving joints. The elimination of these bearings and joints increases the reliability, life expectancy, and accuracy of the horizon scanner in which the device is used. NASA

N69-27484*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPENSATING RADIOMETER
George E. Sweet, inventor (to NASA), William W. Anderson Jr., inventor (to NASA) and Howard B. Miller, inventor (to NASA) Issued 18 Mar. 1969 (Filed 4 Jan. 1967) 6 p Cl. 250–83
(NASA-Case-XLA-4556; US-Patent-3,433,953; US-Patent-Appl-SN-607608) Avail: US Patent Office CSCL 20F

A radiometer is described which is capable of measuring low level radiant energy and which consists of a mount made of a material having a low thermal conductivity, low specific heat, low outgassing, and good dimensional stability over a large temperature range. A metal with good thermal conductivity is used for a sensor and compensating shield in order to minimize thermal gradients. The upper surfaces of these elements, which face the radiation to be measured, are coated with a material of high absorptance. Two temperature detectors, such as thermocouples or resistance thermometers, are attached to the upper surfaces of the sensor and compensating shield. The under surfaces of the sensors and compensating shield are coated with a low emittance material and the compensating shield is larger than the sensor so that the exposed surface of the shield will also receive direct radiant energy, thus reducing the temperature gradient between the sensor and shield. Official Gazette of the U.S. Patent Office

N69-27485*# National Aeronautics and Space Administration. Washington, D.C.
OPTICAL SPIN COMPENSATOR
Joseph R. Burke, inventor (to NASA) Issued 18 Feb. 1969 (Filed 22 Oct. 1965) 5 p Cl. 250–203
(NASA-Case-XGS-2401; US-Patent-3,428,812) US-Patent-Appl-SN-502740) Avail: US Patent Office CSCL 20F

An optical scanner is developed which is to be used on a rotating support structure; means are incorporated for continuously receiving an image and stopping the rotation of the image with respect to the support so that a stationary image is projected onto a sensor mounted on the support structure. The device is particularly adaptable to be mounted on a space vehicle for scanning a relatively stationary distant object such as the earth, moon, etc. NASA

N69-27486*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VARIABLE STIFFNESS POLYMERIC DAMPER
Jerome J. Lohr, inventor (to NASA) Issued 4 Mar. 1969 (Filed 11 May 1967) 8 p Cl. 248–18
(NASA-Case-XAC-11225; US-Patent-3,430,902; US-Patent-Appl-SN-638707) Avail: US Patent Office CSCL 14B

A vibration damping device is described comprising a solid, high molecular weight, substantially amorphous polymer which is utilized at a temperature within the region of the glass transition temperature. The polymer changes from a hard, substantially rigid condition at a temperature below the polymer's glass transition temperature to a viscous condition at a temperature in the region of the glass transition temperature. In the viscous condition the polymer is an efficient and reliable vibration damper. When the ambient temperature is below the glass temperature, means are provided for heating the polymer to the glass temperature region. The heating means may be employed for heating the polymer to above the glass transition temperature to return the polymer to its original shape, if a polymer with a built-in memory is employed. Also, by using the polymer in the temperature range just below the glass temperature the damping increases with an increase in temperature thereby providing an added safety factor. Official Gazette of the U.S. Patent Office

N69-27498# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NONDESTRUCTIVE TESTING OF SMALL DIAMETER, STAINLESS STEEL FUEL CLAD TUBING
J. Ryden, Jr. 1969 20 p refs Presented at Natl. Spring Conf. of the Am. Soc. for Nondestructive Testing, Los Angeles, 10–14 Mar. 1968
(Contract AT(45-1)-1830)
(BNWL-SA-2275; CONF-690311-1) Avail: CFSTI

Techniques used to inspect FFTF fuel cladding for defects are discussed. Descriptions are given of the three different testers used to inspect this tubing. They are a sinusoidal eddy current tester, an ultrasonic pulse-echo tester, and an ultrasonic tester that uses a send-receive system of transducers. Micrographs, strip charts, and statistical data obtained from the inspection of 20,000 feet of tubing are presented. Author (NSA)

N69-27503*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ROCKET CHAMBER LEAK TEST FIXTURE

William O. Wilson, inventor (to NASA) Issued 18 Mar. 1969 (Filed 13 Jul. 1967) 5 p Cl. 73–49.8
(NASA-Case-XFR-9479; US-Patent-3,433,079; US-Patent-Appl-SN-653278) Avail: US Patent Office CSCL 14B

A rocket chamber test fixture is developed which is very rapidly attached to and removed from a rocket chamber; and which does not require disassembling and assembling for the purposes of being used. The device consists of a cross head member adapted to centrally mount a hollow tubular plug member. A handle is pivotally mounted at each end of the cross head member. Each handle has a raised portion which acts as a stop to prevent rotation of the handle beyond a predetermined position when moving toward each other. Pivotally mounted on each handle is a hook arm which has a long shank terminating in an inwardly facing hook. The hook arms are pivotally suspended above and eccentrically from the handle pivotal suspension on the cross head. In operation, the hook arms are slipped over a rim, which is formed on a rocket chamber head, and the tubular lug member is slidably positioned on the cross head member to be insertable into the opening in the flared portion of the rocket motor exhaust. NASA

N69-27542# Atomic Energy Commission Research Establishment, Riso (Denmark).
A SIMPLE DIGITAL TIMER
L. R. Jenkin Nov. 1968 11 p
(RISO-M-830) Avail: AEC Depository Libraries

A digital timer is described, employing TTL integrated circuit logic, which achieves with simple circuits a clock rate of 10 MHz, almost the toggling limit of the flip-flops used. The method of setting the time delays from a remote control panel uses a sequential code, and withstands interference. The timer, control panel, and output pulse generators are easily changed for different delay sequences. Author (NSA)

N69-27558# Sandia Corp., Albuquerque, N.Mex.
ROLAMITE CASE METROLOGY BY GRAZING INCIDENCE INTERFEROMETRY
E. S. Roth Dec. 1968 15 p refs
(SC-DR-68-873) Avail: CFSTI

The use of grazing incidence interferometry to inspect the geometry of the rolamite pumper case is described. Pumper cases made of four separate parts were used to evaluate the interferometry technique. This interferometry technique is an applicable test for any high quality surface with microinch surface finish and size requirements. It is particularly useful in determining the geometry of surfaces in physically inaccessible locations. Complete explanations of the interference phenomena are not included because this material is available in engineering textbooks. Author (NSA)

N69-27567# New Hampshire Univ., Durham. Engineering Design and Analysis Lab.
PSYCHROMETRIC PROPERTIES OF HELIUM-WATER VAPOR MIXTURES: A STUDY OF THE RELATIONSHIP BETWEEN TEMPERATURE, PRESSURE AND HUMIDITY, AND WET AND DRY-BULB TEMPERATURES Final Report, Feb. 1967–Aug. 1968
Oswald T. Zimmermann and Robert C. Ramsey Aug. 1968 64 p refs
(Contract N00014-67-A-0158)
(AD-683348; TR-106) Avail: CFSTI CSCL 14/2

With mans increasing interest in exploring the ocean at greater and greater depths, it was found necessary to replace the nitrogen of the normal atmosphere with helium to provide a breathing gas for those living at ambient ocean pressure. This led to a need for a knowledge of the psychrometric properties of helium at pressures up to several hundred pounds per square inch. This investigation has resulted in: (1) the development of psychrometer, (2) the development of a psychrometric equation for the helium-water vapor system, and (3) the development of a computer program which makes it possible to print out psychrometric charts for any ocean depth. Author (TAB)

N69-27589# Sandia Corp., Albuquerque, N.Mex.
ELECTRON SPECTROMETER FOR CARIBOO-III
F. M. Raymond Sep. 1968 40 p refs
(SC-DR-68-420) Avail: CFSTI

The design of an electron spectrometer for Cariboo III is described including electronics and calibration. Author (NSA)

N69-27600# Weapons Research Establishment, Salisbury (Australia).
A SPECIAL PURPOSE SPECTRORADIOMETER
E. R. Johnson Oct. 1968 16 p refs
(TN-HSA-136) Avail: CFSTI

The instrument consists of a modified Zerny-Turner mirror-grating monochromator, a 250 mm aperture Cassegrain type objective and an E.M.I. type 9558QB photomultiplier. The grating drive is automatic and covers the wavelength range from 290 nm to 880 nm in times as short as 10s. A turret of 4 pairs of slits gives resolutions of 5, 1.6, 0.5 or 0.16 nm. The whole instrument is mounted on an alt-azimuth mount so that in use in the field it can follow artificial luminous clouds used for upper atmosphere research. It is not sensitive enough to detect the night sky at 5 nm resolution. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-26154# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF DIAGNOSING FAILURE OF ANTI-FRICTION BEARINGS
A. I. Eroshkin et al 12 Nov. 1968 27 p refs Transl. into ENGLISH from Sb. Statei Prochnost i Dinam. Aviats. Dvicatelei (Moscow), no. 4, 1966 p 214–230
(AD-683982; FTD-MT-24-312-68) Avail: CFSTI CSCL 13/9

A discussion of methods and for early detection of turbine engine bearing failure. Techniques mentioned involve analysis of metallic particles trapped in engine oil by various means, monitoring, of the electrical resistance of bearings (as a means of determining continuity of oil film on friction surfaces), and spectrographic analysis of noises generated by bearings under different conditions. Equipment used is described and illustrated. Author (TAB)

N69-26311*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF OXYGEN CONCENTRATION ON AN ADVANCED ESTER LUBRICANT IN BEARING TESTS AT 400° AND 450°F
Richard J. Parker and Erwin V. Zaretsky Washington Jun. 1969 14 p refs
(NASA-TN-D-5262) Avail: CFSTI CSCL 13I

Tests were run with 20-mm bore angular-contact ball bearings at 400° and 450°F (477 and 505 K) to determine the effects of

oxygen concentration on the oxidation of an advanced Type II ester. The bearings were run at 10 600 rpm and 70-pound thrust load. Oxygen content of the gas in the bearing chamber was varied from less than 0.1 percent to approximately 21 percent by volume. Increases in bearing torque, lubricant viscosity, and acid number were used as indicators of lubricant oxidation and degradation. The advanced ester exhibited less oxidation than did a synthetic paraffinic oil under similar test conditions. A time limitation (induction period) on the effectiveness of the oxidation inhibitor in the ester was indicated. Author

N69-26314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF OXYGEN CONCENTRATION ON THE PERFORMANCE OF SYNTHETIC PARAFFINIC OILS IN SHORT TERM BEARING TESTS FROM 400° TO 500°F
Richard J. Parker and Erwin V. Zaretsky Washington May 1969 18 p refs
(NASA-TN-D-5152) Avail: CFSTI CSCL 13I

The effect of ambient oxygen concentration on the performance of a synthetic parafinic oil with and without an oxidation inhibitor was studied in bearing tests at 400° to 500°F. Bearing torque increase was correlated with increases in lubricant viscosity due to lubricant oxidation. The viscosity and total acid number of the uninhibited oil increased as oxygen concentration increased. The viscosity increases were attributed to bearing operation in the presence of oxygen. Tests with the bearing not rotating produced relatively small increases in viscosity. The oxidation inhibitor significantly reduced oxidation of the oil at 400°F for oxygen concentrations up to 21 percent. Longer term bearing tests at 400°F show a limitation on the effective life (induction period) of the lubricant with the oxidation inhibitor. Author

N69-26428# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
AUTOMATIC FILLING OF LIQUID NITROGEN TRAPS. AUXILIARY SAFETY DEVICES OF A PUMPING UNIT [ALIMENTATION AUTOMATIQUE DES PIEGES A AZOTE LIQUIDE: SECURITES ANNEXES D'UN GROUPE DE POMPAGE]
Serge Chatel Jan. 1969 24 p refs In FRENCH; ENGLISH summary
(CEA-R-3710) Avail: CFSTI

The liquid nitrogen traps in the CEA laboratories are generally filled at fixed time intervals. The supply is cut when the liquid flowing through the overflow pipe acts on a lever, to which is fixed a small cup fitted with a hole, which allows the water of condensation to escape. This system is quite reliable. After a certain time however, the escape hole blocks up, water accumulates and the lever arm no longer works properly. Furthermore the duration of any cuts in current is added to the fixed time intervals, so these can be a lack of liquid nitrogen for several hours after the current has been restored. The device described here avoids these problems. A stainless steel tube containing a copper wire passes into the trap and is immersed in the nitrogen which boils at its tip. A mercury manometer with concentric reservoirs, or an oil manometer, acting on two microswitches through a floater, records the pressure corresponding to the difference in level and controls the filling operation. If there is a lack of nitrogen, a valve can be closed by means of a falling weight, or a diffusion pump can be cut off; one time switch and at least two relays are required. One single relay can be used to control the supply of several similar traps placed in series. Author (ESRO)

N69-26513# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISLOCATION-ENERGY ANALYSIS OF STRENGTHENING AND PROSPECTS OF INCREASING CYCLIC STRENGTH OF METALS
V. S. Ivanova 8 Nov. 1968 23 p refs Transl. into ENGLISH from Materialy Soveshch. po Ustralosti Metallov (Moscow), no. 4, 1967 p 5–14
(AD-683983; FTD-MT-24-315-68) Avail: CFSTI CSCL 11/6

Analysis shows that further increase of strength and life of machine parts is possible with such change of structural state which ensures effective arrestment of dislocations and other defects in metal. The greater the ability of a metal in given structural state to arrest developing dislocations and other defects, the more effectively will the reserves of strength of the given metal be utilized. Maximum utilization of bond strength is attained with 100% holdup of developing dislocations. Author (TAB)

N69-26578# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ULTRASONIC REMOVAL OF STRESSES IN PARTS AFTER PLASTIC DEFORMATION
E. G. Konovalov, V. I. Efremov, and V. K. Rimskii 24 Oct. 1968 7 p refs Transl. into ENGLISH from Plastichnosti i Obrabotka Metallov Davleniem (Minsk), 1964 p 202–204
(AD-683959; FTD-HT-23-894-68) Avail: CFSTI CSCL 13/8

The report discusses the results of a program to find a method for removing internal stresses after reeling cylinders so that the dimension of the cylinder remained constant after removing the enveloping ring, which is used to protect the opening in the cylinder skirt against distortion during reeling. The ultrasonic method was selected since the work-hardened surface of the cylinder opening after reeling was thermodynamically unstable and ultrasonic vibrations always promote the transition of metal from a thermodynamically unstable state to a more stable one by removing internal stresses. Author (TAB)

N69-26677 Pittsburgh Univ., Pa.
EXPERIMENTAL DETERMINATION OF DYNAMIC PROPERTIES OF LUBRICANT FILMS
Albert Anthony Raimondi (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-16626

A test machine for determining the dynamic properties of lubricant films is described. The bearing, which is free to move, is excited by force generators while the rotating shaft is rigidly held in ball bearings. The dynamic response, that is, the displacement and phase angle, is measured. From these data, spring and damping constants are computed. Static and dynamic performance of a tilting pad journal bearing are compared with previous experimental results and theoretical curves. Dissert. Abstr.

N69-26745# Battelle Memorial Inst., Columbus, Ohio.
VAPOR SOLID NUCLEATION: KINETICS OF FORMATION OF EPITAXIAL THIN FILMS Final Report
R. D. Gretz 31 Jan. 1969 55 p refs
(Grant DA-ARO(D)-31-124-G624)
(AD-683531) Avail: CFSTI CSCL 20/2

The objective of the work was to clarify the interrelationship of competitive processes in the incidence of epitaxy in the vapor deposition system gold on molybdenum. A new contamination effect caused by oil diffusion pumps was discovered that caused an evanescent approach toward the major objective. For this reason a getter pump LEED system was constructed in order that structures formed during vapor deposition could be discerned in a contaminant free system. Author (TAB)

N69-26749# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
RESEARCH ON FAILURE INDICATOR SYSTEM Interim Report, 1 Apr. 1967–31 Jul. 1968

Bob V. Markevitch and Jacob van Heeckeren 31 Jul. 1968 35 p ref
(Contract N00014-67-C-0401)
(AD-683369; RR-68-19; IR-1) Avail: CFSTI CSCL 14/2

Recording and frequency analysis by means of coherent optical data processing techniques is described with special emphasis on the detection or diagnosis of failures in rotating mechanisms. Vibration signals from bearing assemblies have showed good correlation with themselves and poor cross correlations, implying the possibility of detection of specific bearing noise signatures. Author (TAB)

N69-26796# Israel Program for Scientific Translations, Ltd., Jerusalem.
FABRICATION OF TARGETS BY DIRECTED VAPORIZATION IN A HIGH VACUUM
L. G. Lishenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 517–518 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

In order to reduce the dispersion of the vaporizing metal in the metallothermal fabrication of isotopic targets, the technique of directed vaporization in high vacuum was employed. The nitrogen trap used is schematically shown; it comprised a copper tube coil continuously cooled by liquid nitrogen, with a single Teflon vacuum slab insulating the trap from the metallic slab in the working chamber. The trap design permitted setting up a potential difference of up to 1000 V between the vaporizer and the condenser; the voltage applied to the trap was of the same sign as the vaporizer voltage. The metal vapors thus drift in one direction, and nearly all the vaporized metal condenses properly on the base, without settling on the trap. Author

N69-26801# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF ENERGY TRANSFER IN CENTRIFUGAL AND MIXED-FLOW PUMPS BY CIRCULATION AND CORIOLIS FORCES
B. V. Ovsyannikov et al 11 Sep. 1968 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 4, 1966 p 107–113
(AD-683225; FTD-HT-23-68368) Avail: CFSTI CSCL 13/11

An analysis is presented of some problems of designing centrifugal and mixed-flow pumps from the point of view of the energy transfer processes. It was previously shown (Ovsyannikov, B. V., Aviatsionnaya tekhnika, no. 2, 1963) that in a centrifugal pump the energy is transferred to the fluid by Coriolis inertia forces and circulation forces (i.e., forces associated with the circulation of relative velocities around impeller blades). Formulas are derived for calculating these forces, and relationships are obtained for these forces and certain geometric pump parameters. It is noted that this type of approach to pump analysis makes it possible to explain various relationships established by experience and to obtain new knowledge which would be of great value in designing centrifugal and mixed-flow pumps. Author (TAB)

N69-26850 Cincinnati Univ., Ohio.
THE DESIGN-SYNTHESIS OF THE R-S-S-R LINKAGE
James T. Scroggin (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilm: HC $6.40/Microfilm $3.00 Order No. 68-15193

The R-S-S-R spatial four-bar linkage was chosen for study because of its practicality. This linkage, which employs two revolute pairs and two spheric pairs, has constrained motion. There are many means by which this linkage has been analyzed. The analysis presented in this work uses a vector approach to develop a design-synthesis technique. The linkages synthesized by the procedure contained in this work have a defined angular velocity at a given design position. The rate of change of the angular velocity ratio with respect to the input link motion also has a specified value. These two values, the angular velocity ratio and its derivative with respect to the input angle, can be assigned by the linkage designer. This allows the designer to obtain a desired functional relationship between the input and output cranks of an R-S-S-R linkage. Higher order derivative relationships can also be obtained after first solving for linkages which satisfy the above mentioned values. Dissert. Abstr.

N69-26898*# Boeing Co., Seattle, Wash. Missile and Information Systems Div.
DEMONSTRATION OF MANUFACTURING TECHNIQUES FOR APPLICATION OF HIGH PERFORMANCE CRYOGENIC INSULATION Final Report, 1 May–11 Sep. 1968
Sep. 1968 52 p
(Contract NAS8-21341)
(NASA-CR-98459; D2-139267-1) Avail: CFSTI CSCL 13D

A mock-up of a 45 degree segment of a 200-inch diameter Torus tank was fabricated of wood and fiber glass. The purge system, constructed of blue nylon for photographic clarity, was fabricated, installed on the mock-up and demonstrated. The insulation system was composed of five blankets of insulation each one-inch thick composed of alternate layers of nylon tulle and aluminized mylar film encapsulated in nylon net. The insulation blanket segments were installed on the mock-up using the designated insulation support systems. Photographs were taken of the mock-up, insulation system fabrication and insulation installation for a sequential record. The unit was disassembled, packaged and shipped to the Marshall Space Flight Center, Alabama where it was reconstructed and demonstrated. Author

N69-26941 University of Southern Calif., Los Angeles.
AUTOMATIC CONTROL SYSTEMS FOR LEGGED LOCOMOTION MACHINES
Andrew Alfonso Frank (Ph.D. Thesis) 1968 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-17022

It is shown that a kinematic model can produce previously unsuspected theoretical results relating to the dynamic stability of certain types of gaits. In particular, it is demonstrated for quadruped systems that the common crawl gait used by animals for very slow locomotion possesses the best stability properties. The results of the kinematic stability theory are used to design a very simple finite state controller to implement a quadruped crawl. A trot gait was also successfully realized in experiments with this machine. A six degree of freedom dynamic model for a higher speed locomotion machine is developed. This model has been programmed to permit the study of arbitrary gaits and control laws without the necessity of constructing additional machines. The results show that it is possible to obtain stable locomotion by means of an automatic control system even for gaits in which the machine never finds itself in a statically stable condition. Dissert. Abstr.

N69-26945 Columbia Univ., New York.
THE DYNAMIC BEHAVIOR OF A TUBULAR REACTOR WITH AXIAL MIXING
David N. Deutsch (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-16903

The dynamic behavior of a tubular reactor with axial mixing, in the presence of a liquid phase second-order chemical reaction, was studied both theoretically and experimentally. Historically, two distinct mathematical models have been proposed to account for the presence of axial mixing in tubular reactors. They are the so-called finite-stage model and the diffusion model. As an important part of this research, digital computer programs have been written to integrate the equations of both of these mathematical models numerically. The accuracy of these programs has been demonstrated in two separate ways. First, the solutions have been shown to be

invariant with changes in step size. Second, the results of these programs for special cases have been compared with those obtained by independent means and the agreement was found to be excellent. Dissert. Abstr.

N69-28986# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF ACTION OF SPRAYED LUBRICATING-COOLING LIQUIDS
G. I. Yakunin et al 23 Aug. 1968 7 p refs Transl. into ENGLISH from Akad. Nauk UzSSR Izv. Ser. Tek. Nauk (USSR), no. 4, 1967 p 32–34
(AD-683220; FTD-HT-23-514-68) Avail: CFSTI CSCL 13/9

To determine whether the effectiveness of using sprayed liquids in machining lay in its cooling or lubricating capacity, air and oxygen were used as the spraying gas and a 2.5% emulsion as the sprayed liquid. The experiments were carried out with high-speed cutters at three different feed rates. The experiment demonstrated that the highest durability was obtained when cutting with a stream of oxygen without fluid, i.e., in this case the most essential factor influencing cutter durability was not cooling but the properties of surface films that formed, since blowing with oxygen at such a low flow rate cannot cause appreciable cooling. Hence follows that the effect of sprayed lubricating-cooling fluids on the durability of a cutting tool is associated with the capacity to create protective films. Author (TAB)

N69-28992*# Alabama Univ. Research Inst., Huntsville.
EXPERIMENTAL ANALYSIS OF LOW PROFILE FLANGE CONNECTIONS Final Technical Report
W. K. Kubitza and G. L. Hearne Mar. 1969 87 p refs
(Contract NAS8-21067)
(NASA-CR-98458) Avail: CFSTI CSCL 13E

A comprehensive experimental investigation of a low profile bolted flange connection is described. The investigation includes a qualitative examination of surface stresses using brittle lacquer and photoreflective techniques, a three-dimensional photoelastic analysis of an epoxy model using the stress-freezing method, and a strain gage analysis at selected points on the model. The techniques employed for casting and fabrication of the model are described in some detail. The experimental results are compared with theoretical values calculated for both the flange and adjacent pipe section, and in general, show good agreement. The conclusion reached is that the low profile flange is a basically sound design, showing very low levels of stress concentration, except in the areas immediately beneath the bolt heads. The combination of flange depth and bolt spacing used, provide an even distribution of stress at the flange to gasket interface. The design and flexibility of the gasket are found to have a significant effect on the stress distribution in both the flange and pipe sections. Author

N69-28995# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF CERTAIN SHALE PRODUCTS AS CORROSION INHIBITORS
R. E. Metsik 22 Oct. 1968 7 p Transl. into ENGLISH from Tekhnol. i Organ. Proizv. (Kiev), no. 5, 1966 p 95–97
(AD-683540; FTD-HT-23-631-68) Avail: CFSTI CSCL 13/8

The effect of H2O-sol. shale phenols on the corrosion of C steel in aq. solns. of AcOH, NH4Cl, K2SO4, HCl, KCl, and H2SO4 was studied. The corrosion rate decreased by a factor of 5-25. A shale de-emulsifier used in the desalination of oils had an analogous action. The presence of a shale de-emulsifier in an amt. of 5 g./1. in a 0.5N H2SO4 soln. decreased the corrosion of C steel from 23 to 1.5 g./sq. m. hr. TAB

N69-28996# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETRIC RESONANCE OF A ROTOR ON ROLLER BEARINGS
A. P. Valdman et al 14 Nov. 1968 10 p refs Transl. into ENGLISH from Akad. Nauk LatSSR, Izv. Ser. Fiz. i Tekhn. Nauk (Latvia), no. 3, 1966 p 86–91
(AD-684004; FTD-HT-23-633-68) Avail: CFSTI CSCL 13/9

Rolling contact bearings are regarded as elastic bodies depending for their toughness on the type of bearings, the number and the position of rollers. With any load it is possible to mark infinitely numerous zones of unsteadiness having a definite corresponding number of bearing retainer revolutions. Experiments indicate that the first two areas of unsteadiness are dangerous. The conventional method of calculating rolling contact bearings according to the coefficient of efficiency should be supplemented with some formulae of verification. If the chosen number of bearing retainer revolutions is in the area of unsteadiness, another bearing should be chosen. Author (TAB)

N69-27062*# Martin Co., Orlando, Fla.
QUALITY WELD PARAMETERS FOR MICROWELDING TECHNIQUES AND EQUIPMENT Final Report
W. R. Hutchinson and L. G. Hall Huntsville, Ala. NASA. Marshall Space Flight Center Jan. 1969 58 p refs
(Contract NAS8-21326)
(NASA-CR-61277) Avail: CFSTI CSCL 13H

A limited amplitude, controlled decay (LACD) welding concept was optimized on this program to improve the weldability of component lead materials of electronic modules. During this study it was observed that the weldability of OFHC copper could be significantly improved by welding to nickel wire instead of ribbon with the stipulation that the nickel wire must always be the larger of the two. Of the materials evaluated in this program, kovar, nickel, dumet, and OFHC copper, the LACD process improved welding ranges by a factor of 2 to 4X. Author

N69-27063*# General Dynamics/Convair, San Diego, Calif.
EVALUATION OF THE RADIOGRAPHIC THRESHOLD DETECTION LEVEL OF SUBSURFACE CRACK-LIKE DEFECTS IN ALUMINUM WELDS, 24 JANUARY–15 AUGUST 1968
R. W. Tryon Huntsville, Ala. NASA. Marshall Space Flight Center Sep. 1968 59 p refs
(Contract NAS8-20185)
(NASA-CR-98355) Avail: CFSTI CSCL 13H

This report describes a test program whose primary objective was to design and fabricate special graduated aluminum penetrameters to evaluate the threshold detection capabilities of a fixed radiographic technique in detecting surface and subsurface cracks in one-quarter inch aluminum welds. Tapered slits of predetermined dimensions were selected to simulate aligned weld cracks by bonding the penetrameters to the centerline of the weld of a matched set of weld test plates. Penetrameter thicknesses of 0.001, 0.002, 0.003, 0.004, and 0.005 in. were used to simulate crack depth. A total of 80 radiographs were taken, employing the same radiographic technique, equipment, and materials in all cases. The radiographic films were evaluated by five highly competent film interpreters and the threshold detection capabilities of the fixed radiographic technique were defined and compared in terms based on relationships between minimum detectable width, depth, and length of the slits and the maximum radiographic sensitivities achieved for the graduated hole penetrameters. Author

N69-27078*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS ON ROTATING EXTERNALLY PRESSURIZED, AIR JOURNAL BEARINGS. PART 1: LOAD CAPACITY AND STIFFNESS
Robert E. Cunningham, David P. Fleming, and William J. Anderson Washington Jun. 1969 17 p refs
(NASA-TND-5191) Avail: CFSTI CSCL 13I

A series of tests was conducted to determine the load and stiffness characteristics of a pair of orifice-compensated, externally pressurized journal bearings. The diameters were a nominal 6.3 cm and the length 9.5 cm. Each bearing was equipped with 12, 0.56-mm diameter orifices. The orifices were arranged in two circumferential planes, six equally spaced in each plane. Results were obtained at an average radial clearance of 0.034 mm over a speed range of 0 to 25,000 rpm. Radial loads were varied up to 189 pounds per bearing or 20.2 psi unit load and air supply pressure ratios from 1.7 to 6. The results of these tests show that load capacity is generally less than that predicted by linearized PH theory or by pressure perturbation theory. Agreement is fair at eccentricity ratios up to 0.1 and at higher supply pressures. A comparison of test results with the two perturbation theories shows that the observed load capacity data agree better with the pressure perturbation theory. Overall load capacity is increased by shaft rotation (self-acting effects). The increase is greatest at the higher eccentricity ratios and lower supply pressures. Experimental data of stiffness as a function of compressibility number are in close agreement with theory at the higher supply pressures. Author

N69-27079*# Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.

PROPELLANT EXPULSION BLADDER FOR THE SATURN S/S-4B Quarterly Report, 1 Nov. 1968–31 Jan. 1969

R. L. Hallman 31 Jan. 1969 25 p refs

(Contract NAS8-21149; RMD Proj. 5125)

(NASA-CR-98456; RMD-5125-Q5; QR-5) Avail: CFSTI CSCL 13H

Difficulty experienced in goldplating the six inch diameter mandrel prompted the preparation and delivery of a back-up six inch mandrel for plating. Successful plating of the first six inch mandrel was accomplished. Development of an improved adhesive system has been completed following extensive evaluation of systems utilizing state-of-the-art adhesives. CNR liquid polymer and NR copolymer. Resistance to delamination throughout seven days exposure to N_2O_4 has been demonstrated to be repeatable. Development of a CNR coating technique has continued with the conclusion that bladder fabrication will be initiated using a brush coating procedure. The program schedule will require an extension in time to permit bladder fabrication and testing following receipt of plated mandrels. Author

N69-27135# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELF-LUBRICATING POLYMER MATERIALS IN ROLLER BEARINGS

V. E. Vaynshteyn et al 21 Feb. 1968 14 p Transl. into ENGLISH from Mashinostroitel (Moscow), no. 5, 1966 p 18–20

(AD-683944; FTD-HT-23-57-68) Avail: CFSTI CSCL 11/8

The use of the following polymeric self-lubricating materials in the construction of roller bearings on the high-temperature and vacuum performance and longevity of the bearings was investigated: polyacetal, MoS_2 + epoxy resin, polyamide + graphite, and teflon + fiber glass. The performance of Cr-Mo-V and steel ShKh15 roller bearings was compared. It was found that the performance of the roller bearings improved considerably if the latter were equipped with a special polyamide ring. The most effective lubricant was found to be the combination teflon + fiber glass. TAB

N69-27263# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DEVELOPMENT OF ANTIFRICTION BEARING DESIGNS

P. N. Sidorov 7 Aug. 1968 17 p refs Transl. into ENGLISH from Vsesoyuznyy Nauchno-Issled. Konstrukt.-Tekhn. Inst. Podshipnikovoy Prom. (Moscow), nos. 3 and 35, 1963 p 31–39

(AD-683195; FTD-HT-23-97-68) Avail: CFSTI CSCL 13/9

The report discusses newly produced and updated designs of antifriction bearings; improved durability and load capacity of bearings are considered. A classical expression is given for calculating the durability of antifriction bearings. Author (TAB)

N69-27272*# General Motors Corp., Indianapolis, Ind. Allison Div.

SINGLE-STAGE EXPERIMENTAL EVALUATION OF BOUNDARY LAYER BLEED TECHNIQUES FOR HIGH LIFT STATOR BLADES. PART 3: DATA AND PERFORMANCE OF UNSLOTTED 0.75 HUB DIFFUSION FACTOR STATOR

G. Seren and R. H. Carmody Sep. 1968 155 p refs

(Contract NAS3-7900)

(NASA-CR-54571; EDR-5863-Pt-3) Avail: CFSTI CSCL 13G

The test described is part of an overall program to establish experimentally the extent to which it is feasible to increase compressor stator loading and stall free flow margin by employing suction surface boundary layer bleed techniques. The unslotted stator vanes in this test are used with the objective of providing a basis of comparison for the blade suction surface boundary layer control using blowing and bleed techniques. During this test, the only attempt to control the flow in the boundary layer was done by means of varying hub and case wall bleeds. A secondary objective of this test was to obtain blade element data for design use. In this test, overall and blade element performance of a row of 0.75 diffusion factor unslotted stator vanes was measured with varying wall bleed rates for boundary layer control. In addition, the vane static pressure distribution was obtained at three radial locations and for three different wall bleed rates at design speed. Overall and blade element performance was also obtained for the rotor and compared to data previously obtained for this rotor without stator vanes. Preliminary discussion of test results and correlations of data are presented. Author

N69-27321# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOSCOW SCIENTIFIC-ENGINEERING CONFERENCE ON METAL CUTTING

L. D. Ponomarev 12 Sep. 1968 8 p Transl. into ENGLISH from Mashinostroitel (Moscow), No. 12, 1967 p 41–42

(AD-683162; FTD-HT-23-605-68) Avail: CFSTI CSCL 11/6

A conference on metal cutting was held in Moscow. Reports and discussions pertaining to the subjects of general interest were presented. Author (TAB)

N69-27356# Technische Hochschule Hannover (West Germany). Fakultaet Fuer Maschinenwesen.

NEW METHOD FOR MEASURING FORCES, WORK PROCESSES, FORM CHANGES, RATES OF FORM CHANGES, AND STRENGTH AFTER FORM CHANGES DURING WIDENING OF CYLINDRICAL WORK PIECES BY FAST-CHANGING MAGNETIC FIELDS [EIN NEUARTIGES MESSVERFAHREN ZUR BESTIMMUNG DER KRAEFTE, ARBEITEN, FORMAENDERUNGEN, FORMAENDERUNGSGESCHWINDIGKEITEN UND FORMAENDERUNGSFESTIGKEITEN BEIM AUFWEITEN ZYLINDRISCHER WERKSTUECKE DURCH SCHNELLVERAENDERLICHE MAGNETISCHE FELDER]

Bauer Dietrich (Ph.D. hesis) 1967 123 p refs In GERMAN

Avail: CFSTI

Described is an electro-optical method for measuring the effects of process variables on high energy forming of steel, copper, and aluminum pipes by transient magnetic fields. This method employs a vacuum type oscillator to monitor the voltage-time expansion rate of the outer rim of the radial enlarging pipe and displays the signal on a photoelectric receiver. Transl. by G.G.

N69-27378# Stanford Linear Accelerator Center, Calif.

RECENT DEVELOPMENTS IN THE DESIGN OF SUPERCONDUCTING MAGNETS

H. Brechna Dec. 1968 63 p refs Presented at the Meeting of Am. Phys. Soc., Miami Beach, Fla.
(SLAC-PUB-528; CONF-681119-2) Avail: CFSTI

The most important magnets, avilable or currently being built, are described to illustrate the advances of the past two to three years in superconducting magnets. Type 2 superconductors, which are commercially available and have been shaped and processed into various types of magnet conductor, such as Nb_xTi and Nb_3Sn, are considered specifically. Medium-size solenoids and Helmholtz configurations, beam transport, and large experimental magnets are covered. NSA

N69-27442# Idaho Nuclear Corp., Idaho Falls.
EQUIPMENT AND TECHNIQUES FOR SEALING AMPOULES CONTAINING IRRADIATED U-235 SOLUTIONS
D. R. Trammell, M. A. Wade, E. M. Fortsch, H. G. Brinkley, and G. A. Huff Jan. 1969 10 p refs
(Contract AT(10-1)-1230)
(IN-1257) Avail: CFSTI

Evaporation through poorly made seals is suggested as the cause of irradiated ^{235}U solutions concentrating in ampoules during storage. Recently developed improved ampoule sealing techniques and equipment are described which overcome this problem. Author (NSA)

N69-27449# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTED ARTICLES FROM KHARKOV POLYTECHNIC INSTITUTION. POWER MACHINERY CONSTRUCTION
D. Ya. Aleksaposkii et al 5 Aug. 1968 29 p refs Transl. into ENGLISH from Energ. Mashinostr. (Kharkov), no. 2, 1966 p 12–18, 59–64
(AD-683204; FTD-HT-23-601-68) Avail: CFSTI CSCL 13/11

Contents: Effect of precision in the manufacture of impeller components on the characteristics of a pump stage; Effect of the fineness of machining the impeller on the losses in a pump. TAB

N69-27477# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE RELIABILITY OF BINARY COUNTING SYSTEMS BY THE MODULO-n-CHECK
I. L. Erosh et al 30 Jul. 1968 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 10, no. 5, 1967 p 72–74
(AD-683196; FTD-HT-23-387-68) Avail: CFSTI CSCL 9/5

It is shown that the combination of redundancy with a modulo-n-check scheme insures greater reliability in counting systems, as compared to systems based on counting redundancy combined with selective circuits. TAB

N69-27483*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVAPORANT HOLDER
Cary R. Spitzer, inventor (to NASA) Issued 4 Mar. 1969 (Filed 17 Feb. 1966) 4 p Cl. 263–48
(NASA-Case-XLA-3105; US-Patent-3,430,937;
US-Patent-Appl-SN-529594) Avail: US Patent Office CSCL 14B

A boat-shaped holder is described for holding small quantities of a material which is to be evaporated under high vacuum in a temperature range of 200° to 1320°C. The holder is fabricated from a tantalum–tungsten alloy foil cut and bent so as to form an evaporant reservoir and a pair of exposed conductive tabs. This reservoir also has a laminated protective coating of nickel alumina and ceramic (zirconia, chromia, alumina, or zirconium silicon oxide). The coatings are flame sprayed onto the foil and were designed to resist degradative chemical and physical reactions when exposed to elevated temperatures and reduced pressure environments. NASA

N69-27490*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TUBULAR COUPLING HAVING FRANGIBLE CONNECTING MEANS
James W. Mayo, inventor (to NASA) Issued 11 Feb. 1969 (Filed 30 Nov. 1966) 4 p Cl. 285–3
(NASA-Case-XLA-2854; US-Patent-3,427,047;
US-Patent-Appl-SN-598118) Avail: US Patent Office CSCL 13E

A sound mechanical joint or connection was developed which can be instantaneously released. The structure is extremely simple in design, with no moving parts, thereby providing high reliability while avoiding the disadvantages of known devices by eliminating undesirable shock and debris. The insert connector assembly for coupling a pair of primary members of an aerospace vehicle consists of male and female elements with complementary Helical grooves; an abutment to limit the sliding movement of the male element; and an insert consisting of a metal sheathed explosive, such as a mild detonating fuse, wire of bimetallic compositions which exothermically deflagrate, or wire of a material having a selected melting point. NASA

N69-27502*# Chrysler Corp., Huntsville, Ala.
APPARATUS FOR EJECTION OF AN INSTRUMENT COVER
Bernie R. Wells and Charles W. Rowland, inventors (to NASA) Issued 25 Feb. 1969 (Filed 17 May 1967) 5 p Cl. 220–55
(NASA-Case-XMF-4132; US-Patent-3,429,477;
US-Patent-Appl-SN-640788) Avail: US Patent Office CSCL 13E

A method and apparatus are developed for ejecting a cover from an instrument case, utilizing the force of differential pressure between the inside of the instrument case and the environment of the case. An air-tight seal, positioned between the cover and the case, allows the case to be pressurized, so that the cover ejects when it is released. The device has a plurality of cover latches rotatably mounted on the side of the case and latch retaining means to secure the latches against rotation. Releasing means consisting of cable cutters are provided to cut the cable and thereby release the latches. NASA

N69-27504*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BELLEVILLE SPRING ASSEMBLY WITH ELASTIC GUIDES
Louis R. Toth and William F. Mac Glashan, Jr., inventors (to NASA) Issued 4 Mar. 1969 (Filed 17 May 1967) 6 p Cl. 267–1
(NASA-Case-XNP-9452; US-Patent-3,430,942;
US-Patent-Appl-SN-640789) Avail: US Patent Office CSCL 13I

An improved Belleville spring assembly with very low hysteresis was designed. The assembly consists of a plurality of flexible inner and outer retainers, properly spaced from one another by means of grooves in the retainers within which the inner and outer peripheries of the springs are supported. The retainers are in turn supported so that under load when the inner and outer radii of the springs decrease and increase respectively, the retainers flex to accommodate such changes in dimensions within the elastic limits of the retainers. The elastic guides and the spaces, provided for frictionless flexing, account for the low hysteresis of the assembly which can be produced at a lower cost than prior art assemblies. NASA

N69-27508*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE-RESISTANT SHEAR PIN
Thomas W.E. Hankinson, inventor (to NASA) Issued 4 Mar. 1969 (Filed 28 Feb. 1967) 3 p Cl. 64–28
(NASA-Case-XLA-9122; US-Patent-3,430,460
US-Patent-Appl-SN-619903) Avail: US Patent Office CSCL 13I

A shear pin was made having a hollow shaft fitted with

two plugs with chamfered ends that abut at the plane where shear is to occur on overload. Official Gazette of the U.S. Patent Office

N69-27554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH OF TURBINE DISKS
V. P. Rabinovich 18 Nov. 1968 141 p refs Transl. into ENGLISH of Prochnost Turbinnykh Diskov (Moscow), 1966 p 1–151
(AD-683273; FTD-HT-23-494-68) Avail: CFSTI CSCL 10/1

This book is intended for engineers and scientific research personnel working in the field of steam and gas-turbine manufacturing. The book reviews theoretical principles of methods and experimental findings which serve for evaluating disk strength. The effect of properties of materials, systems of disks and operational conditions which affect disk strength are discussed and basic requirements which disk materials and systems have to satisfy are stressed. Special attention is paid to problems of preventing brittle and quasi-brittle failures of disks and other machine parts. Author (TAB)

N69-27565# Sperry Gyroscope Co., Ltd., Brentford (England).
A REPORT ON THE METHODS OF ACHIEVING A CONNECTION BETWEEN THE TRACKS ON OPPOSITE SIDES OF A PRINTED WIRING CARD
A. J. Bayfield Nov. 1968 17 p refs /ts Tech. Note No. 984
Avail: CFSTI

The common methods of connecting tracks on opposite faces of a printed wiring card are described, and their technical and production performance discussed. Emphasis is placed on plated-through hole techniques which are examined in more detail. References to both internal and external evaluation work are made, and copies of reports are included wherever possible. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-26215# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE TRANSFORMATION OF LASER RADIATION BY OPTICAL SYSTEMS
K. Kelov 13 Nov. 1968 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk Turk. SSR, Ser. Fiz.-Tekhn., Khim. Geol. Nauk (Ashkhabad), no. 4, 1967 p 38–44
(AD-683985; FTD-MT-24-343-68) Avail: CFSTI CSCL 20/5

The cross section of 6328-A He/Ne-laser beams during propagation through the atmosphere and through optical systems was investigated. After demonstrating the Gaussian nature of the TEM sub 00 mode of this laser, an empirical formula was derived which described the beam broadening during propagation. Nonuniform intensity distribution was shown to be caused by interference phenomena upon passage through various lens systems. TAB

N69-26295# Signals Research and Development Establishment, Christchurch (England).
UP-CONVERSION OF A LASER-INDUCED QUASI-CONTINUUM (THE RAINBOW LASER)
M. D. Martin and E. L. Thomas Jun. 1968 25 p refs
(AD-683841; SRDE-68020) Avail: CFSTI CSCL 20/5

A method is described whereby a relatively narrowband (8/cm) source of radiation, which is tunable over most of the visible and near infrared spectral regions, can be generated. Tuning curves and power/wavelength curves are presented. The dependence of tunable output power on crystal length was also investigated. This latter investigation provided indirect evidence for the phenomenon of beam-trapping. The mechanism and potential of this tunable source are discussed. Author (TAB)

N69-26595# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
OPTICAL PUMPING FOR MILLIMETER-WAVE MASERS
John C. Clark and Richard W. Grow Jun. 1968 151 p refs
(Grant NSF GK-29)
(PB-180040; MD-68-053; NSF-17) Avail: CFSTI CSCL 20E

Optical pumping may be used to obtain large population differences in a steady-state condition at any temperature. Because high optical powers are available, it can provide a very useful pump source for millimeter-wave masers. In this report four different models of optical pumping schemes are presented and a rate equation analysis of each is given. The four models analyzed are the three-level optical pump, the broad-band pumping of a dichromic material, and two cases of four-level internal pumping, with and without lasing into the upper level of the maser transition. The internal pumping scheme where lasing occurs to the upper level of the maser transition is shown to be the most suitable technique for obtaining an optically pumped millimeter-wave maser where suitable materials are available. Author (USGRDR)

N69-26713 Cornell Univ., Ithaca, N.Y.
LINE STRENGTHS, PUMPING RATES AND EXCITATION MECHANISMS OF THE SINGLY IONIZED RARE GAS LASERS
Howard Marantz (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-16757

In this study, detailed calculations have been carried out on singly ionized Neon, Argon and Krypton to determine approximately the wave functions, line strengths and radiative lifetimes for all the laser and laser related states of these ions. New experimental data is presented on the intensities of the spontaneous emission spectra of Kr-2 under typical continuous wave (cw) laser discharge conditions. The calculations, together with these data, have enabled us to determine for this ion: (1) the pumping rates for all of the upper laser states; (2) the relative importance of collisional and cascade processes in exciting these states; (2) the population densities for all of the upper laser and laser related states. These results were used to determine the important physical mechanisms taking place in the cw Kr-2 laser. Dissert. Abstr.

N69-26762# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERNAL MODES IN A RUBY LASER
E. A. Tikhonov et al *In its* Ukrain. Phys. J., vol. 12, no. 3 1967 p 421–425 refs (See N69-26781 14-23)
Copyright. Avail: CFSTI

A study was made of the effect of internal modes on the energy and time characteristics of a ruby laser for various axial and internal mode thresholds. Analysis of the experimental data suggested that internal mode excitation is a fundamental factor limiting the maximum attainable population inversion, especially for polished ruby specimens. The internal modes lower the laser output energy, and the decrease becomes more pronounced for low Q cavities. Internal modes furthermore cause considerable heating of the laser medium and thus raise the lasing threshold. The internal modes can be effectively suppressed by partially immersing the

ruby in liquids with $\epsilon_1 = 2.0$. The low energy efficiency of Q switched lasers is explained and a method for increasing this efficiency is indicated. Author

N69-26820# Israel Program for Scientific Publications, Ltd., Jerusalem.
TUNING AND FREQUENCY STABILIZATION IN A RUBY LASER
M. V. Danileiko et al *In its* Ukrain. Phys. J., vol. 12, no. 4 1967 p 622–625 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

Adjustable selective cavities with frequency-sensitive Q factors were used to control the stimulated emission frequency of a luminescing ruby laser. A tilted Fabry–Perot selector interferometer determined lasing thresholds by cavity loss and laser gain in the ruby R_2 line and smoothly tuned the neodymium glass laser in the interval up to 600Å. The smooth tuning range coincided with the selector period: it was equal to 4.1Å and close to the half-width of the ruby R_1 luminescent line at room temperature. Laser spectrum width for maximum attainable pump levels did not exceed 0.05Å in the entire tuning range. G.G.

N69-27089# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
A FOCUS DETECTOR AS AN AID FOR FOCUSING A LASER ON A TARGET [EIN FOKUSDETEKTOR ALS HILFSMITTEL BEI DER FOKUSSIERUNG EINES LASERS AUF EIN TARGET]
K. Büchl Dec. 1968 15 p In GERMAN; ENGLISH summary
(IPP-3/82) Avail: CFSTI

An apparatus is described which assesses the focus of a laser on a surface. An image of the focus is scanned by fiber optics. A moving slit together with a photodetector behind the fibers detects whether a fiber is illuminated or not. When the focus coincides with the surface of the target, the number of illuminated fibers is a minimum. The apparatus is especially advantageous for adjustment when the radiation is not visible, for example, with neodymium lasers or with frequency doubled radiation from ruby lasers. Author (ESRO)

N69-27148# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF THE OUTPUT POWER FOR A SIMPLER MODEL OF THE MIXTURE CARBON DIOXIDE AND NITROGEN
B. I. Stepanov et al 6 Sep. 1968 10 p ref Transl. into ENGLISH from Dokl. Akad. Nauk BSSR (Minsk), v. 12, no. 1, 1968 p 13–17
(AD-683106; FTD-HT-23-561-68) Avail: CFSTI CSCL 20/5

A simple model of a generating CO2-N2 mixture was investigated in detail. A simple method used to estimate the power output makes it possible to avoid cumbersome calculations of the nonlinearity parameter. The excitation probability of the upper nitrogen level (S) is determined from the velocities and the number of the exciting electrons, i.e., the pumping power. Probabilities of deactivation of the upper laser level are computed as functions of particle concentration (N) in the mixture and the efficiency of the collisions. The magnitudes of level populations, emission power, the power expended for nitrogen excitation, and the quantum output are tabulated for high excitation probability and deactivation values. For small nitrogen concentrations and high excitation probabilities, the output power is determined from the number of energy transfers from nitrogen to carbon dioxide. Formulas presented make it possible to estimate the dependence of output power on the loss factor. Author (TAB)

N69-27167 Hahn-Meitner-institut fur Kernforschung, Berlin (West Germany). Strahlenphysik Div.
PARTICLE SIZE SPECTROMETRY OF AEROSOLS BY LIGHT SCATTERING IN A LASER BEAM [TEILCHENGROESSEN-SPEKTROMETRIE VON AEROSOLEN DURCH LICHTSTREUUNG IN EINEM LASERSTRAHL]
W. Jacobi, J. Eichler, and N. Stolterfoht Nov. 1967 32 p refs In GERMAN; ENGLISH summary
(HMI-B-65; B-SP-7) Avail: CFSTI

A particle size spectrometer for aerosols is described, which measures the light scattered by single particles in a laser beam. The device was calibrated with mono-disperse Latex-aerosols. The spectrometer marks out by a small scattering volume (0.05 mm^3) and its good size resolution (3–12%, depending on particle size). The lowest detectable particle diameter is 0.3μ. Author

N69-27203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN RESULTS OF INVESTIGATION OF A CRYSTAL OF RDP (RbH_2PO_4) USED AS LASER FREQUENCY MULTIPLIER
Ye. V. Nilov et al 1 Aug. 1968 10 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. no. 6, 1967 p 943–945
(AD-683110; FTD-HT-23-477-68) Avail: CFSTI CSCL 20/5

Optical frequency doubling by means of an RDP crystal was investigated. The Q-switched neodymium glass laser used in the investigation emitted 45-Mw pulses and had a beam divergence of 5 sec of arc. Fully polarized emission was obtained by using a stack of Brewster-angle plates inside the cavity. The angular dependence of the second harmonic power and the dependence of the transformation coefficient on power density were investigated for 1–2-cm RDP crystals. The power density was varied by means of an f = 19 cm cylindrical lens. Transformation of the laser output into the second harmonic occurred through the k10 + k1e yields k2e interaction (where k10 and k1e are the wave vectors of the primary ordinary and extraordinary beams and k2e is the wave vector of the secondary extraordinary beam). Disagreement between the experimental and theoretical results is attributed to crystal imperfection, inaccurate calculation of refractive indices, and improper crystal orientation. Author (TAB)

N69-27207# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IONIZATION OF MEDIA AND CREATION OF PLASMA WITH HELP OF LASER RADIATION
G. A. Askaryan 7 Jun. 1968 18 p refs Transl. into ENGLISH from Tr. Fiz. Inst., Akad. Nauk SSSR (USSR), v. 32, 1966 p 89–96
(AD-683171; FTD-MT-24-42-68) Avail: CFSTI CSCL 20/9

This article contains a survey of works dedicated to the investigation of the possibility of using laser radiation to solve such problems of plasma physics as ionization of media, creation of sterile plasma, heating of dense plasma, filling of plasma traps, and strong influence on atoms and molecules. TAB

N69-27342# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
LASER PROPAGATION EFFECTS OVER A HALF-MILE PATH
W. C. Plake and G. E. Walsh Mar. 1968 25 p refs
(Contract AT(29-1)-1162)
(EGG-1183-2176; S-418-R) Avail: CFSTI

A study was made to experimentally determine atmospheric effects on propagation of a collimated laser beam over a half-mile path. Data were taken to define movement of the centroid of the received beam, measure changes in envelope size of the received beam, changes in angle of arrival, and changes in the received power of the total beam. The measurement system is described, and a brief analysis of the experimental method used in the study which was performed at the Nevada Test Site is given. The data collected during the study are summarized, and the results are discussed. Author (NSA)

N69-27453# National Lead Co. of Ohio, Cincinnati.
FEASIBILITY OF USING A LASER AS AN ILLUMINATING SOURCE FOR OPTICAL MICROSCOPY
E. L. Schaich 25 Sep. 1968 13 p refs Presented at the 18th Ann. Natl. Lead Co. Anal. and Phys. Testing Symp., Hightstown, N.J., 17–18 Oct. 1968
(Contract AT(30-1)-1156)
(NLCO-1034; CONF-681044-1) Avail: CFSTI

A helium–neon laser was used as the light source in a Bausch and Lomb metallograph in an attempt to extend the useful magnification range of the optical microscope. Results indicate that image contrast is greatly increased but resolution is essentially unchanged. NSA

N69-27491*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RETRODIRECTIVE OPTICAL SYSTEM
Peter O. Minott, inventor (to NASA) Issued 18 Mar. 1969 (Filed 31 Oct. 1966) 8 p Cl. 250–199
(NASA-Case-XGS-4480; US Patent-3,433,960; US-Patent-Appl-SN-591007) Avail: US Patent Office CSCL 20E

An optical communication system is described which uses a remote retrodirective reflector modulator which is responsive to a remote information source. The modulator is a modified interferometer of the Fabrey-Perot type having non-planar surfaces. It is used in conjunction with a communications system in which an information carrying beam of light transmitted from a station on earth is relayed by a satellite to another station on earth. Inherent advantages of the laser communications system over a microwave system for use in space include higher transmission efficiencies and savings in the weight and size. NASA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 08 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-26164# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMING THE TEXTURE IN COLD ROLLING OF INDUSTRIAL TITANIUM
V. V. Mukhayev et al 23 Aug. 1968 9 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Tsvet. Met. (Dzaudzhikau), v. 11, no. 1, 1968 p 151–154
(AD-683094; FTD-HT-23-694-68) Avail: CFSTI CSCL 11/6

The forming of the texture of titanium alloys in cold rolling is discussed. The cold-rolling was done in one direction, strips of metal were used which were planed on one side and then subjected to etching. The effects of slipping and twinning are discussed. Author (TAB)

N69-26167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW HEAT-RESISTANT MATERIALS FOR WORK IN CONTACT WITH REFRACTORY METALS
A. L. Burykina, O. V. Evtushenko, T. M. Evtushok, and L. V. Strashinskaya 7 Nov. 1968 17 p Transl. into ENGLISH from Novye Materialy v Mashinostr. (USSR), 1967 p 46–57
(AD-683958; FTD-HT-23-892-68) Avail: CFSTI CSCL 11/6

The most promising field for wider application of refractory metals and compounds is their use as protective coatings on metals and various nonmetallic materials. The article reviews results of systematic research to develop a technology for protecting refractory metals with coatings made from refractory compounds (carbides, nitrides, borides) of these metals. The research includes an investigation of the solid phase interaction between refractory compounds, between refractory metals and refractory compounds of these metals, and between refractory metal compounds and graphite. Author (TAB)

N69-26169# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF MOLTEN GLASS FOR HEATING STEEL BLANKS
I. V. Anisimova et al 15 Nov. 1968 18 p Transl. into ENGLISH from Kuznechno-Shtampovochnoye Proizv. (USSR), v. 9, no. 2, 1967 p 37–40
(AD-683986; FTD-MT-24-345-68) Avail: CFSTI CSCL 13/8

Experiments were made to develop the composition of protective glass lubricants for hot extrusion of turbine blades and to evaluate various coating methods. Heating the turbine blade blanks in a bath of molten glass was found to be the technological method most likely to ensure reliable protection against scale formation on carbon and alloy steels in a wide temperature range (800-1300C). Author (TAB)

N69-26183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF MECHANICO-THERMAL TREATMENT ON THE HEAT RESISTANCE OF TITANIUM ALLOY ST-1
T. T. Nartova et al 23 Aug. 1968 12 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 6, 1967 p 40–45
(AD-683095; FTD-HT-23-478-68) Avail: CFSTI CSCL 11/6

The article deals with the improvement of methods of thermoplastic treatment to increase the heat resistance through combined thermo-mechanical action. This action consists of deforming the material (under conditions of creep) at room temperature not higher than the temperature of the beginning of recrystallization. The extensive investigations in recent times of methods of strengthening titanium alloys are discussed. Author (TAB)

N69-26192*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EVALUATION OF TWO NICKEL-BASE ALLOYS, ALLOY 713C AND NASA TAZ-8A, PRODUCED BY EXTRUSION OF PREALLOYED POWDERS
John C. Freche, William J. Waters, and Richard L. Ashbrook Washington May 1969 33 p refs
(NASA-TN-D-5248) Avail: CFSTI CSCL 11F

Prealloyed powders of Alloy 713C and TAZ-8A were made by inert gas atomization and extruded. The powder products were

evaluated by tensile and stress rupture tests in the as-extruded and heat-treated conditions. Significant improvements in room temperature and 1200°F (649°C) strength were obtained over the as-cast condition, but lower strengths and superplastic behavior were observed for the extruded powder alloys in the 1800° to 2000°F (982° to 1094°C) temperature range. It was possible to hot form the TAZ-8A powder product at low strain rates and low applied loads. Heat treatments eliminated superplasticity. Author

N69-26205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL RESISTANCE ON NICKEL–COPPER ALLOYS (30–50% Cu) AND ITS CHANGES IN A MAGNETIC FIELD AT LOW TEMPERATURES
O. S. Galkina et al 23 Jul. 1968 refs Transl. into ENGLISH from Vestn. Ser. 3, Fiz., Astron. (Moscow), v. 21, no. 5, 1966 p 123–125
(AD-683104; FTD-HT-23-386-68) Avail: CFSTI CSCL 11/6

Results are given of a study of electrical resistance (R) and changes in it due to a longitudinal magnetic field at 1.7-78K. Some data on alloys with less than 30% Cu obtained in previous work (CA 52, 15160d) are included; the exptl. procedure is also described in that work. Author (TAB)

N69-26217# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF HARDENING METHODS ON THE ABRASION WEAR RESISTANCE OF IRON ALLOYS
G. I. Ivantsov et al 15 Nov. 1968 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz (Tomsk), v. 10, no. 7, 1967 p 16–19
(AD-683965; FTD-HT-23-986-68) Avail: CFSTI CSCL 11/6

Hardness and wear tests were made to determine the effect of hardening by quenching and tempering, alloying, precipitation hardening, carbides, and increasing the carbon content, on the wear resistance of various steels, and to relate it to Vickers hardness (Hv). The wear tests were made in wet Fe ore. The wear resistance of steels hardened to Hv of 500 kg/mm2 by quenching and tempering, precipitation hardening, and alloying was increased by a factor of 1.5; the wear resistance of steels hardened to 500, but contg. excess carbides in martensite was increased 6-fold, and with carbides in austenite 13-fold. Hardening due to excess phases (carbides) with strong interat. bonds produces high wear resistance; hardening by dispersion, block refining, coherent lattice distortions in supersatd. solid solns., and lattice distortions increase the wear resistance only to a moderate extent. Author (TAB)

N69-26253*# Aztec School of Languages, Inc., Maynard, Mass.
STUDY OF THE EFFECT OF TEMPERATURE AND POROSITY ON THE STRENGTH OF CARBIDES OF CERTAIN REFRACTORY METALS DURING COMPRESSION [ISSLEDOVANIYE VLIYANIYA TEMPERATURY I PORISTOSTI NA PROCHNOST' PRI SZHATII KARBIDOV NEKOTORYKH TUGOPLAVKIKH METALLOV]
V. N. Rudenko Washington NASA May 1969 8 p ref Transl. into ENGLISH from the Publ. "Termoprochnost' Materialov i Konstruktivnykh Elementov" Kiev, Izd. AN Ukr. SSR, 1967 p 98–102
(NASw-1692)
(NASA-TT-F-12251) Avail: CFSTI CSCL 11F

The results of an investigation of the strength of cylindrical specimens of niobium, tungsten, molybdenum, chromium, and titanium carbides at temperatures up to 2300°K under vacuum during compression are presented. All these materials show a monotonous decrease in compression strength with the temperature, marked to different degrees; in titanium carbide, it undergoes a steep drop above 1300°K. Author

N69-26258*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
LEED STUDY OF THE ADHESION OF VARIOUS MATERIALS TO THE (111) SURFACE OF NICKEL
Donald H. Buckley Washington May 1969 23 p refs
(NASA-TN-D-5247) Avail: CFSTI CSCL 11F

Adhesion studies were made with copper, tungsten, oxidized tungsten, and quartz contacting a nickel (111) surface. The copper, tungsten, oxidized tungsten, and quartz were in the form of 1 mm diameter flat ended fibers. Loads of 20 to 150 mg were employed with surface contact times of 10 to 300 sec. The nickel (111) surface was examined before and after adhesion contact with LEED. With clean metals, fracture in tension occurred in the lower cohesive strength material. When copper contacted nickel, a surface alloy formed. The contacting of clean nickel with an oxidized tungsten surface resulted in oxygen transfer from tungsten to nickel with surface rearrangement. Quartz adhered to nickel with fracture occurring in the quartz on separation of the surfaces. Author

N69-26286 Michigan State Univ., East Lansing.
QUANTUM OSCILLATIONS IN THE PELTIER EFFECT IN ZINC
Harry Joseph Trodahl (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-17148

Peltier measurements were used to study quantum oscillations in the thermoelectric power of zinc single crystals. The three lowest frequencies, due to the α, β and γ orbits, were observed at temperatures ranging from 1°K and 4.5°K and in fields to 22 kilogauss. The amplitudes found were between .01 and 1 $\mu v/K^2$. An attempt has been made to correlate the results of these measurements with an expression derived by Horton. As his calculation is valid only for the case of a free electron sphere, his results were heuristically extended to include metals with complex Fermi surfaces. The theory and measurements agree only on the form of the temperature dependence; neither the absolute amplitude nor the field dependence is correctly predicted by the theory. It is suggested that the primary source of the disagreement may be found in the rather simplified scattering potential assumed by Horton. Dissert. Abstr.

N69-26288 Cornell Univ., Ithaca, N.Y.
FAR INFRARED ABSORPTION IN SUPERCONDUCTING AND NORMAL Pb
Howard Dennis Drew (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilms $3.00 Order No. 68-16175

The far infrared surface resistance of Pb in both the superconducting and normal states has been measured using several new experimental techniques. Some surface resistance data on Sn, Ta, and Nb are also presented. A novel sample geometry was used in which the metal in the form of a ribbon, together with polyethylene ribbon, was wound into a transmission line configuration with a spiral cross section. This sample geometry has the advantages of permitting simple transmission ratio measurements with the detector in a position far removed from the sample and giving a rise to an optimal modulation of the incident radiation. Also, a new He^3 bolometer detector was developed for these measurements which was composed on an In and Sb doped germanium cooled to 0.4°K by a He^3 evaporator. This bolometer has a NEP of 3×10^{-14} watts and is probably the most sensitive detector of far infrared radiation yet developed. In addition to the transmission line experiments, a supplemental direct absorption experiment was done on Pb. Dissert. Abstr.

N69-26304# Naval Research Lab., Washington, D.C.
CORRELATION OF TWO FRACTURE TOUGHNESS TESTS FOR TITANIUM AND FERROUS ALLOYS
C. N. Freed and R. J. Goode 16 Jan. 1969 28 p refs
(AD-683659; NRL-6740) Avail: CFSTI CSCL 11/6

High-strength ferrous and titanium alloys are of interest for use in complex structures; a knowledge of the notch fracture toughness of these alloys is necessary to preclude catastrophic failure. A previously established relationship between the dynamic tear test energy and the explosion tear test performance provides reliable fracture-toughness information of those alloys characterized by a toughness level requiring plastic deformation to propagate fracture. This analysis has not been extended to the ultrahigh-strength alloys in which fracture can propagate castastrophically at elastic stress levels. For these alloys, the analytical methods of linear elastic fracture mechanics provide the required elastic stress level and flaw-size relationship for fracture. This report deals with a marriage of the two approaches-the engineering and the analytical-by correlative techniques. Author (TAB)

N69-26404# Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET SINTERED ALUMINUM POWDER (SAP) ALLOYS
Dimitri Vvedensky *In its* A Monthly Rev. of Selected Foreign Sci. and Tech. Vol. 6, No. 4 Apr. 1969 p 131–177 refs (See N69-26403 14-30)
Avail: Issuing Activity

This paper, based on open literature sources published during 1961–1967, reviews the progress made by Soviets in consolidation, plastic working, and fabrication of SAP alloys. Author

N69-26440*# Ottawa Univ. (Ontario). Dept. of Chemistry.
STUDIES ON REDUCTION OF NOBLE METAL SURFACE OXIDES IN RELATION TO ELECTROCHEMICAL OXYGEN REDUCTION Semiannual Report
[1969] 48 p refs
(Contract NGR-52-093-001)
(NASA-CR-101114) Avail: CFSTI CSCL 11F

The project originated from interest in the role of surface oxides on the noble metals in regard to the kinetics of various electrochemical processes such as oxygen reduction of such metals. The three main aspects of the work that were and are being developed in the present reporting period are: (1) develoment of model experiments on reduction of Pt surface oxide at 25°C in relation to interaction effects and rearrangement processes in the surface layer; (2) development of apparatus and technique for study of surface oxide formation and reduction at some noble catalytic metals and alloys at elevated temperatures up to 200°C in water at pressures above 1 atm; and (3) analysis of the results by theoretical procedures based on the treatment of kinetic effects in transients. Author

N69-26500# Bureau of Mines, Boulder City, Nev.
PREPARATION OF ANHYDROUS ALUMINUM CHLORIDE
Robert L. de Beauchamp Jun. 1969 22 p refs
(BM-IC-8412) Avail: Issuing Activity

Aluminum chloride technology was reviewed to determine the problems associated with its preparation from minerals, and to ascertain the best areas for research to solve these problems. Commercial $AlCl_3$ production processes are described, and the state of the art for the preparation of $AlCl_3$ from aluminous materials is evaluated. Areas for further research are indicated. Author

N69-26585# Boeing Co., Renton, Wash. Commercial Airplane Div.
THE USE OF THE ELECTRON MICROPROBE FOR MEASURING AIR CONTAMINATION IN Ti6Al4V
R. H. Olsen 26 Feb. 1969 34 p refs
(AD-683789; D6-73478) Avail: CFSTI CSCL 11/6

Two rather unique methods were developed to determine the extent of air contamination in Ti:6Al-4V using the electron microprobe. One method gives a rapid measure of the contamination depth while the second results in a quantitative oxygen profile. This report describes the two methods in some detail and is demonstrated on three heat treatments. The results are compared to the more conventional optical metallography and microhardness measurements. Author (TAB)

N69-26597# Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.
SPECTROGRAPHIC ANALYSIS OF SOME RARE-EARTHS AND ACTINIDES IN PLUTONIUM
B. D. Joshi, R. N. Saxena, B. M. Patel, T. R. Bangia, and A. G. Page 1968 28 p
(BARC-383) Avail: CFSTI

An emission spectrographic method for the determination of rare earths—cerium, samarium, europium, gadolinium, dysprosium, erbium, lutetium and actinides—uranium and americium, in plutonium, using d.c. arc is described. The rare earths and actinides are separated from plutonium by anion-exchange separation at 7.2 M HNO_3. The effluent containing impurities is concentrated to 200 microlitres. Lanthanum was used as a matrix element and thulium as an internal standard. The estimation ranges by this procedure are: rare earths, 0.2–4.0 p.p.m; americium, 2–40 p.p.m; and uranium 10–200 p.p.m. and the average standard deviation is 15%. Since other impurities from plutonium are also carried along with rare earths in the effluent, the effect of some commonly occurring impurities on the intensity ratios of rare earth analyses lines has been investigated. Author

N69-26634# Oak Ridge National., Tenn. Metals and Ceramics Div.
REFLUXING CAPSULE EXPERIMENTS WITH REFRACTORY METALS IN BOILING ALKALI METALS
J. R. Di Stefano Jan. 1969 36 p refs
(Contract W-7405-ENG-26)
(ORNL-4323) Avail: CFSTI

Heat engines based on nuclear reactors were proposed as a source of electrical power for space vehicles. Since alkali metal-cooled reactors are promising for this application the corrosion resistances of Nb–1% Zr, Nb–10% W–1% Zr (D–43 alloy), Ta–8% W–2% Hf (T-111 alloy), Mo–0.5% Ti–0.1% Zr (TZM), and Nb-10% W–10% Hf–0.1% Y (C-129 alloy) in boiling potassium environment at 1100 to 1400°C were studied. No serious corrosion interactions were observed. Weight changes in insert specimens from the condenser section of the capsules were small and were related to migration of oxygen in the system. The alloy Nb-1% Zr was exposed to refluxing sodium, rubidium, and cesium at 1200°C and found no attack. Refluxing experiments in small-diameter capsules (<0.5 in.) indicated a boiling mechanism unlike that in larger capsules; capsule geometry is an important variable in comparing the results between various corrosion investigations. Author (NSA)

N69-26663# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
STRENGTH DEFORMATION MODES AND FRACTURE IN TITANIUM–ALUMINUM ALLOYS

M. J. Blackburn and J. C. Williams (N.Am. Rockwell Corp., Thousand Oaks, Calif.) Jan. 1969 45 p refs
(AD-683484; D1-82-0812) Avail: CFSTI CSCL 11/6

The variation of yield strength, deformation modes and fracture characteristics of titanium:aluminum alloys containing up to 25% aluminum were studied. This composition range includes three phase fields based on hexagonal phases, a solid solution, and ordered phase based on the composition Ti3Al and a two phase region. An attempt is made to account for the factors that control the strength and fracture characteristics of these alloys. Author (TAB)

N69-26693*# International Harvester Co., Chicago, Ill. Solar Div.
STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS
Mark J. Klein Oct. 1968 15 p
(Contract NAS7-469)
(NASA-CR-101141; RDR-1534-9; Solar-RP-6-2426-9) Avail: CFSTI CSCL 11F

The contribution of solutes to the creep strength of columbium and tantalum base alloys is being studied through their effect on the activation energy for creep. During this period the activation energy for creep of columbium was determined from $0.4T_M$ to $0.65T_M$, and the effects of changes in interstitial concentration on the activation energy for creep of columbium and D43 (Cb–10W–1Zr–0.1C) were studied. The results suggest that the activation energy for creep of these metals below about $0.5T_M$ increases with increasing interstitial concentration. Author

N69-26694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PHASE DIAGRAM OF HAFNIUM–CHROMIUM
V. N. Svechnikov et al 10 Sep. 1968 7 p refs Transl. into ENGLISH from Fazovye Prevrashch. Metal Splavakh Akad. Nauk Ukr. SSR (Kiev), 1965 p 159–162
(AD-683115; FTD-HT-23-292-68) Avail: CFSTI CSCL 11/6

Twenty seven alloys (containing Cr 2.0-99.97 at. %) were melted in a laboratory electric arc furnace, then annealed at 1200 for 100 hrs. and at 1000 for 200 hrs. and the 10-gram ingots were studied by x-ray and by differential thermal analysis. Author (TAB)

N69-26714# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
RADIATION HARDENING EFFECTS IN Zr-BASE ALLOYS
S. Ray and B. D. Sharma 1968 13 p
(BARC-360) Avail: CFSTI

The neutron irradiation effects on Zr-0.5% Nb-1.0% Cr ternary alloy and some other Zr-base alloys with particular reference to irradiation hardening and its recovery at higher temperatures are discussed. Tensile specimens for irradiation were prepared from drip melted nuclear grade zirconium, niobium foil, and chromium of high purities. Alloy buttons were made by non-consumable arc melting in an argon atmosphere. The buttons were sealed in evacuated copper tubes and rolled. The tensile specimens were fabricated as follows: (1) cold-worked and annealed at 850°C for two hours followed by furnace cooling, and (2) solution treated at 900°C for one hour in vacuum, and water quenched. Tables and charts summarizing the experimental results are included. F.O.S.

N69-26716 Alfred Univ., N.Y. Coll. of Ceramics.
WETTING OF CERAMIC OXIDES BY INDIUM, GALLIUM, TIN AND SILVER
Foster Laverne Harding (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-16618

The wetting of three ceramic oxides (periclase, quartz, and sapphire) by three low-melting metals (In, Ga, Sn) was studied under ultra-high vacuum conditions. The contact angles, works of adhesion, and interfacial free energies were found for all nine of the above mentioned systems. The interfacial free energies of the molten metals were redetermined as well. These properties correlated with many other properties of the metals and oxides allowing some conclusions about prediction of wetting phenomena. In addition, the results suggested the need for better understanding of metal-ceramic interfacial phenomena. The explanation of wetting in metal-ceramic systems due to Livey and Murray was found to agree with the results from this study. A pronounced dependence of θ, W_a, and γ_{SL} upon γ_{LV} and especially γ_{SV} was noted. Dissert. Abstr.

N69-26766# Israel Program for Scientific Translations, Ltd., Jerusalem.
CARBIDE TRANSFORMATIONS IN CHROMIUM–TUNGSTEN TOOL STEEL
A. L. Medved *In its* Ukrain. Phys. J., vol. 12, no. 3 1967 p 441–446 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

An attempt is made to follow the carbide transformations in steels alloyed with carbide forming elements which alter the steel properties and are apparently also responsible for the changes in their phase transformations during heat treatment. The elastic properties of the chromium–tungsten–manganese steels were also measured. X-ray diffraction patterns were analyzed to determine the carbide precipitate interference lines of the steels annealed at various temperatures. B.P.

N69-26776# Israel Program for Scientific Translations, Ltd., Jerusalem.
SOME REGULAR FEATURES OF STRUCTURE FORMATION IN NICKEL AND PERMALLOY VACUUM CONDENSATES
M. V. Belous et al *In its* Ukrain. Phys. J., vol. 12, no. 3 1967 p 469–471 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

Electrolytic nickel and permalloy (82.5% Ni and 17.5% Fe), alloyed by the electron beam method in a vacuum in a water-cooled copper crucible, were investigated. Thin films were vacuum deposited onto a dielectric base. The rate of deposition was maintained nearly constant; film thickness was measured. The phase composition of the films was determined by electron diffraction. The base temperature during film condensation and subsequent isothermal ageing was varied from 20 to 450°C. Kinetic resistivity curves were recorded automatically using an EPP-09 electronic potentiometer. An equation is presented which describes the time rate of variation of the film resistance, determined by the concentration of various defects in the film and by their annealing behavior. The index n is taken as a measure of complexity of the process mechanism; its experimental dependence on the base temperature for vacuum deposited and isothermally aged films is indicated. P.A.B.

N69-26786# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMAL ELECTROMOTIVE FORCE OF ZINC–TIN LIQUID ALLOYS
Ya. I. Dutchak et al *In its* Ukrain. Phys. J., vol. 13, no. 3 1967 p 496–497 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

A phase diagram of Zn–Sn alloys is presented as a eutectic diagram with a very low solutility of tin in solid zinc. Thermal electromotive force (EMF) was measured in relation to alumel using the Kurnakov pyrometer. Alloys were studied with the weight percentages of Sn varying from 0 to 100 percent; the absolute thermal EMF of the liquid alloys vs. composition at 500, 600, and 700°C is plotted. The thermal EMF of alloys with a high percentage content of zinc is positive, while it is negative for tin-rich alloys. It is found that as the temperature increases, the absolute thermal EMF shifts somewhat in the direction of negative values. The assumption of short-range statistical distribution of atoms for the Zn–Sn eutectic is consistent with experimental findings. The distinct singularities in the temperature dependence of resistivity suggest that the eutectic changes do melt with a uniform distribution of atoms as the temperature increases slightly above the melting point. P.A.B.

N69-26824# Radio Corp. of America, Harrison, N.J. Special Electronic Components Div.

SILICON GERMANIUM THERMOELECTRIC MATERIALS AND MODULE DEVELOPMENT PROGRAM Quarterly Report, 1 Jul. – 30 Sep. 1968

30 Sep. 1968 59 p

(Contract AT(29-2)-2510)

(ALO-2510-3; QR-3) Avail: CFSTI

Research directed toward characterization and improvement of the SiMo hot shoe materials and refinement of the fabrication and bonding techniques is reported. A spectrographic technique for the quantitative analysis of B in SiGe was developed. Various phases of the SiMo alloy were identified by electron microprobe. Thermal conductivity and electrical resistivity of silicon carbide, SX-4 graphite, and SiMo(n-TYPE) were determined as functions of temperature. A four-couple reference design module with graphite hot shoes was fabricated. Performance test results obtained for reference design converter closely correlated with analytical projections of output. A high L/A (50 cm^{-1}) thermocouple and a four-couple module were completed. Fabrication of a 5-watt foil-insulated converter was begun. The relative efficiency test device was completed and testing of the four-couple reference design module was initiated. Codes for computer analysis of radiantly coupled cascade systems were completed and applied to SiGe sl-vac couples cascaded with isotec panels. NSA

N69-26828# Boeing Co., Renton, Wash. Commercial Airplane Div.

THE EFFECT OF DEFORMATION VOIDS ON AUSTENITE GRAIN GROWTH IN STEELS

Donald Webster 26 Feb. 1969 33 p refs

(AD-683570; D6-23821) Avail: Issuing Activity CSCL 11/6

Voids have been found to form around carbide particles in a martensitic stainless steel and a low alloy steel during working. The voids are metastable in austenite at high temperatures and result in a considerable refinement of austenite grain size by acting as barriers to grain growth. Deformation in both the austenitic and martensitic conditions results in void formation. Author (TAB)

N69-26848 Pittsburgh Univ., Pa.

A TRANSMISSION ELECTRON MICROSCOPY INVESTIGATION OF RECRYSTALLIZATION MECHANISMS IN CHROMIUM-MANGANESE-NITROGEN AUSTENITIC STEEL

Harshadray Jivanram Bhatt (Ph.D. Thesis) 1968 126 p

Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14172

Hardness measurements were used to detect the onset of recrystallization in 20 and 60 per cent cold rolled steel. The mode of deformation in Cr-Mn-N austenitic steel is inhomogeneous, and forms dislocation cell structure, stacking faults and microtwins on deformation at room temperature. Microtwins contain substructure. The presence of stacking faults and microtwins suggest very low stacking fault energy in this material. The recrystallization mechanisms were studied using isochronal (15 minutes at temperature) and/or isothermal annealing of specimens having different amounts of stored energy due to cold rolling (20 and 60 per cent reduction in thickness). Hardness measurements on the isochronally annealed specimens showed that the specimen having lower driving force (20 per cent cold rolled) recrystallized in a range of temperatures between 600°C and 900°C; whereas the specimens with higher driving force (60 per cent cold rolled) recrystallized by a sharp drop in hardness within only 100°C temperature range between 600°C and 700°C. Dissert. Abstr.

N69-26881 Nebraska Univ., Lincoln.

ELLIPSOMETRIC STUDY OF AMORPHOUS SELENIUM ON VACUUM-EVAPORATED GOLD

Larry Alvin Wertzenkamp (Ph.D. Thesis) 1968 229 p

Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-18039

Reflectivity measurements of thin selenium films on gold indicate a layer of selenium, adjacent to the gold, approximately 130 angstroms in thickness which is significantly different from the remainder of the film. The change in optical properties of selenium in this layer result from the intimate contact with the gold substrate. Material above the first 130Å had optical properties of bulk amorphous selenium. Measurements were made with an ellipsometer which was sensitive to an average thickness change as small as 0.1Å. Selenium, having a relatively high vapor pressure for a solid (3×10^{-9} torr at room temperature), evaporated slowly from the samples while in the ultrahigh vacuum system where reflectivity was measured. This allowed a slow variation in thickness while assuring a clean surface at all times. Thickness and complex refractive index were determined from ellipsometry data by using computer-assisted curve-fitting procedures. Dissert. Abstr.

N69-26893# National Aerospace Lab., Amsterdam (Netherlands).

SYSTEMATIC ELECTRON FRACTOGRAPHY OF FATIGUE IN ALUMINIUM ALLOYS

D. Broek and W. J. van der Vet Nov. 1967 65 p refs

(NLR-TR-68002) Avail: CFSTI

Numerous measurements of striation spacing in aluminum alloys were carried out. The relation between striation spacing and crack propagation rate is discussed. The effect of inclusions on fatigue crack propagation is considered and explanations are given for several special features of fatigue fracture surfaces. The mechanism of striation formation is discussed. Author

N69-26931# Israel Program for Scientific Translations, Ltd., Jerusalem.

IONIC TRANSFER OF CARBON IN SOME REFRACTORY METALS

D. F. Kalinovich et al *In its* Ukrain. Phys. J., vol. 13, no. 4 1967 p 686–688 refs (See N69-26906 14-23)

Copyright. Avail: CFSTI

Carbon transfer numbers were determined in solid solutions based on titanium, tantalum, and tungsten. The alloys contained 0.39, 1.49, and 1.51 at.% carbon, respectively. The transfer was studied in a constant electric field in a wide temperature range. The large variation of temperature was possible because of the

high melting points of these alloys. The temperatures were so chosen that the mobility of carbon was substantial even at the lowest temperatures. The core of specimens, shaped like wire segments 0.5 mm in diameter and about 70 mm long, was labelled with radioactive carbon isotope C^{14} over a length of about 1 cm; the tracer was uniformly distributed across the specimen. A special apparatus was used to determine the activity distribution along the specimen at 0.1 mm intervals. The activity readings were plotted against the distance along the specimen. K.R.G.

N69-26933# Israel Program for Scientific Translations, Ltd., Jerusalem.
A MASS-SPECTROMETRIC STUDY OF THE TOPOGRAPHY OF GASEOUS IMPURITIES IN METALS AND ALLOYS
O. D. Smiyan *In its* Ukrain. Phys. J., vol. 12, no. 4 1967 p 691–693 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

The distribution of gaseous impurities in the structure of high purity metals (after electron beam remelt) was studied. A setup was devised localizing the analysis to 0.015 cm; the sensitivity was 1×10^{-6} wt.% in hydrogen and 2×10^{-5} wt.% in oxygen, the accuracy according to preliminary data being 8%. A technique was also developed of local mass spectroscopic analysis with thermoelectric extraction of gaseous impurities from metals. Results show that the content of gases at the grain boundaries in all metals examined is considerably greater than at the grain centers. The nonuniformity coefficient, defined as the ratio of gas content on a grain boundary to that at the grain center, varies over the specimen cross section according to crystallization conditions. K.R.G.

N69-26952*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CONTROLLED OXYGEN ADDITIONS TO REFRACTORY METALS
Charles A. Barrett Washington May 1969 16 p refs
(NASA-TM-X-1799) Avail: CFSTI CSCL 11F

Controlled oxygen additions (doping) to refractory metals were carried out by a pressure-drop technique involving the use of an oxygen leak into a vacuum system at elevated temperatures. The method and apparatus are described, as well as the variability, precision, and accuracy of the method. Author

N69-26959# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FATIGUE STRENGTH OF ELECTROLYTICALLY BORATED STEEL IN RELATION TO THE CHARACTER OF DISTRIBUTION OF INTERNAL STRESSES
B. G. Gurevich et al 29 Oct. 1968 10 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), v. 3, no. 6, 1967 p 693–699
(AD-683990; FTD-MT-24-380-68) Avail: CFSTI CSCL 11/6

Electrolytic coating of steel with boron, which is accompanied by the formation of high-hardness borides in the surface layer of steel, is employed to enhance the wear resistance of machine parts performing under conditions of abrasive wear. Since such machine parts often are exposed to cyclic loads, it was of interest to elucidate the effect of electrolytic boronizing on the fatigue strength of steels. Accordingly, the results of fatigue tests of electrolytically boronized specimens of 38KhS steel are presented. The decrease in fatigue strength after boronizing is due to the boronizing-induced compressive stresses in the boronized layer; these are balanced by high tensile stresses which are chiefly located in an extremely thin layer directly underneath the boronized layer. TAB

N69-27000# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF ALLOYS OF ZIRCONIUM WITH NIOBIUM AND VANADIUM
M. V. Raevskaya et al 22 Oct. 1968 8 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. II: Khim. (Moscow), v. 22, no. 2, 1967 p 58–62
(AD-683550; FTD-HT-23-618-68) Avail: CFSTI CSCL 11/6

The methods of microscopic and x-ray structural analysis, (micro)- hardness measurement, and high-temperature contactless thermal analysis were used to study the Nb-Zr-V ternary and Zr-Nb and Zr-V binary systems in the cast, annealed, homogenized, and quenched states. Diagrams are plotted and discussed for the 1000 and 10% (atomic) Nb sections of Zr-Nb-V, as well as a diagram of microhardnesses at 1000 and four microsection photographs. Author (TAB)

N69-27051# Watervliet Arsenal, N.Y. Benet Labs.
THE OXIDATION MECHANISM OF NICKEL SILICON ALLOY
Fumihiko Saegusa Dec. 1968 31 p refs
(AD-683609; WVT-6837) Avail: CFSTI CSCL 11/6

Thermogravimetric techniques have been used to study oxidation of nickel alloys containing 0.1 to 3.2 wt % silicon at temperatures up to 1300C. Due to the appearance of internal oxidation the effect of silicon addition on the oxidation process was complex. The thermograms showed a simple curve for lower silicon content, but two consecutive curves for higher content. The oxidation mechanism was interpreted in terms of isothermal kinetics and the corresponding structural changes. Author (TAB)

N69-27059*# Atomics International, Canoga Park, Calif.
SOLUBILITY OF REFRACTORY METALS AND ALLOYS IN POTASSIUM AND IN LITHIUM
R. L. Eichelberger, R. L. McKisson, and B. G. Johnson Washington NASA May 1969 93 p
(Contract NAS3-8507)
(NASA-CR-1371; AI-68-110) Avail: CFSTI CSCL 11F

The solubilities of several pure metals and alloys in liquid potassium and lithium were studied as follows: In K, Ta from the alloys T-111, ASTAR-811C, and Ta–0.5Zr; Nb from the alloys Cb–1Zr and Nb–0.5Zr; Mo from the alloys Mo–0.5Zr and TZM; Hf, Zr, W, and Re from pure metals; in Li, Ta from the alloys T-111 and ASTAR-811C; Hf from ASTAR-811C and pure hafnium; and Mo, W, and Re from the pure metals. The solvent metals were purified by distillation, and were of exceptional purity. All operations in which there might be danger of contamination of the high purity materials were carried out in high vacuum in a complex of interconnected vacuum chambers. Author

N69-27061*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A PROPOSED MODEL FOR THE EFFECT OF OXIDATION ON THE HIGH-TEMPERATURE DEFORMATION OF NICKEL
James S. Wolf Washington Jun. 1969 71 p refs
(NASA-TN-D-5266) Avail: CFSTI CSCL 11F

The high-temperature deformation of unalloyed nickel is strongly affected by the presence of surface scale layers formed when creep tests are conducted in oxygen. Under applied stresses of 6.90 to 13.79 MN/m^2 (1000 to 2000 psi), the deformation rate of specimens at 1000°C is initially enhanced and later retarded upon their contact with oxygen gas. A phenomenological model of the transient creep process is proposed which accounts for these

observations in terms of the self-pressurization and barrier qualities of the scale. A generalization of this model to other materials and to other environments is considered. Author

N69-27101# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE REGULARITY OF PLASTIC LOOSENING OF METALS
O. G. Rybakina and Ya. S. Sidorin 11 Mar. 1968 13 p refs Transl. into ENGLISH from Mekh. Tverd. Tela (Moscow), no. 1, 1966 p 120–124
(AD-683181; FTD-HT-23-18-68) Avail: CFSTI CSCL 11/6

The paper reports investigation of density changes which accompany slow cyclic torsion and simple static extension in the plastic range. Materials included a titanium-alloy, and aluminum-magnesium alloy, copper, a stainless steel, and a carbon steel. An increase of specific volume was observed in each case although its magnitude differed considerably among the various metals. Author (TAB)

N69-27128 Advisory Group for Aerospace Research and Development, Paris (France).
A BIBLIOGRAPHY OF REFRACTORY METALS
Robert Syre, comp. and K. J. Spencer, ed. Maidenhead, Engl. Technivision Serv. 1968 440 p refs
(AGARD-BIBL-5) Copyright. Avail: Technivision Services, Maidenhead, Engl.: $25.00

A literature compilation is presented of four refractory metals and their alloys (niobium, tantalum, tungsten, and molybdenum). This bibliography consists of four main parts: refractory metals and alloys in general; basic research on refractory metals; technology; and protective coatings. Emphasis was placed on the citation of the literature published during the period 1950 to to June 1966, but references to major work of earlier date were included. B.P.

N69-27136# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTION IN A VACUUM
I. M. Lyuberskii et al 2 Oct. 1968 10 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), v. 3, no. 2, 1967 p 197–200
(AD-683145; FTD-HT-23-572-68) Avail: CFSTI CSCL 11/6

The effect of vacuum on the friction behavior of steel has been investigated. It was found that the weight loss of the specimens due to friction increases rapidly with decreased pressure until the pressure reaches a certain value below which the weight also remains constant. Author (TAB)

N69-27144# IIT Research Inst., Chicago, Ill.
STRENGTH OF SINTERED FERROUS PARTS WITH INTERCONNECTED POROSITY Summary Report, 1 Jul. 1967–31 May 1968
S. Bhattacharyya, F. Bock, A. Endres, N. Parikh, and J. Reinart 17 Oct. 1968 131 p refs
(Contract DA-36038-AMC-4333(A))
(AD-683463; IITRI-B6068-23) Avail: CFSTI CSCL 11/6

The report discusses a detailed study of the effect of all the process and powder variables on the mechanical properties of porous sintered (316L) stainless steel parts. The variables were identified and their specific levels were determined. Controlled experiments were conducted following a fractional factorial design; the resulting data were analyzed with a suitable computer program on the IBM 7094 computer to develop individual response equations relating to chosen dependent variables with selected independent variables. Author (TAB)

N69-27152# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
INFLUENCE OF INTERSTITIALS ON THE MECHANICAL PROPERTIES OF GROUP IV b METALS
P. Rodriguez and V. S. Arunachalam 1968 32 p
(BARC-373) Avail: CFSTI

Titanium, hafnium, and zirconium were studied for their alloying behavior, since they form solid solutions not only with substitutional alloying additions, but also rather extensively with the interstitial elements hydrogen, carbon, oxygen, and nitrogen. These elements are in general not soluble to any remarkable degree in metals, and they readily form the second phase compounds when present over a few parts per million. IV b metals, perhaps helped by their crystal structure and accompanying large interstices, are able to accommodate these elements in their original lattices themselves. This leads to drastic alterations in their mechanical and physical properties. Briefly discussed in this paper are the geometry of interstices, lattice parameter changes, volume expansion, flow stresses, thermal stresses, strain aging, internal friction, fracture, and embrittlement. Author

N69-27179# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF METAL BOILING DURING VACUUM TREATMENT IN LADLE OF UNSKILLED BALL BEARING STEEL
V. I. Chuchlov et al 23 Aug. 1968 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 1, 1967 p 41–45
(AD-683161; FTD-HT-23-418-68) Avail: CFSTI CSCL 11/6

Samples of metal and slag were taken before vacuum formation and before deoxidation from a ladle where the metal was 150-160 centimeters deep. Boiling started in the upper levels of the metal, where practically all the cavities were filled with gas; and the degassing proceeded throughout the whole vo. of the metal. The cavitation effect began in the cavities of the lining and at the bottom of the ladle. Author (TAB)

N69-27248# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
STABILITY AND COMPATIBILITY OF HYDROGEN BARRIERS APPLIED TO ZIRCONIUM ALLOYS
F. Brossa, F. Coen, H. W. Schleicher, and G. Volta 1969 42 p refs
(EUR-4098.e) Avail: AEC Depository Libraries

Coatings to protect against hydrogen pick-up Zircaloy 2 in contact with terphenyl were tested. Methods of deposition of coatings and their efficiency as hydrogen diffusion barriers are described. It was found that the most promising barrier against hydrogen diffusion is an Al–Si coating. Results of compatibility tests between Al–Si and Zircaloy 2 are reported. Methods to obtain efficient coatings on laboratory scale are described. Author (NSA)

N69-27271# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-TEMPERATURE COPPER ALLOYS

A. M. Korolkov et al 14 Nov. 1968 10 p refs Transl. into ENGLISH of the publ. "Struktura i Svoistva Zharoprochnykh Metallicheskikh Materialov" Moscow, Izd. Nauka, 1967 p 300–305
(AD-683950; FTD-HT-23-636-68) Avail: CFSTI CSCL 11/6

The effect of a number of alloying elements (Cr, V, Ce, Zr) on the high-temperature resistance of copper at 400 C by using hot-hardness and stress-rupture strength methods has been studied. Author (TAB)

N69-27300*# Israel Program for Scientific Translations, Ltd., Jerusalem.
HIGH TEMPERATURE STRENGTH OF MATERIALS
G. S. Pisarenko, ed., et al. 1969 639 p refs Transl. into ENGLISH of the Book "Prochnost' Materialov Pri Vysokikh Temperaturakh" Kiev, Izd. Naukova Dumka, 1966 Published for NASA and NSF *Its* IPST Cat. No. 5141
(NASA-TT-F-508; TT-68-50308) Copyright. Avail: CFSTI CSCL 11F

The results of investigations of the high temperature strength of materials and machine parts are presented. Emphasis is placed on the methods of investigating the physical and mechanical strength and ductility characteristics of a large class of heat resistant materials (mostly high melting) in a wide temperature range (up to 3500°k), under the action of constant and variable thermal and mechanical loads, inducing simple and compound states of stress. The apparatus, machines, stands, and instruments designed for this purpose are also described. The strength characteristics of different materials subjected to static (short and long time), as well as to vibrational loads, are discussed, together with thermal fatigue and thermal shock, including the cyclic action of high temperature gas flow. Elasticity characteristics and the load carrying capacity of machine parts are examined. The problem of measurement accuracy and reliability and the methods of processing test results with the aid of statistical mathematics are considered. Author

N69-27328# Techniache Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaft.
STUDIES ON THE REACTIONS BETWEEN METALLIC MATERIALS AND ALKALI SULFATES AS AN INDICATION OF CORROSION PROCESSES AT HIGH TEMPERATURES [UNTERSUCHUNGEN UEBER REAKTIONEN ZWISCHEN METALLISCHEN WERKSTOFFEN UND ALKALISULFATEN ZUR DEUTUNG VON KORROSIONSVORGAENGEN BEI HOHEN TEMPERATUREN]
Hans-Peter Voigt (Ph.D. Thesis) 1968 249 p refs In GERMAN
Avail: CFSTI

Quantitative and metallurgical analyses were performed on metal corrosion products after sulfide-oxide attacks on chromium, nickel, and cobalt alloying constituents of steels and heat resistant alloys used in gas turbine structures. Slag deposits on turbine blades developed from reactions if aerosol contaminants and flue dust are present in the system. The main slag components were alkali sulfates, silicon dioxide, iron oxides, and zinc oxides. Observed potassium oxide slags on turbine blades were deposited by the outlet gas and correlated with the sodium oxide/potassium oxide composition of the outlet gas wash water. G.G.

N69-27339# Uppsala Univ. (Sweden). Inst. of Physics.
CYCLIC QUENCHING OF PURE ALUMINUM: A SIMPLIFIED MODEL OF THERMAL FATIGUE
J. Wiberg, Y. Bergstroem, and O. Vingsbo Nov. 1968 16 p refs
(UUIP-614) Avail: AEC Depository Libraries

Very small specimens of pure aluminum with a high initial vacancy supersaturation were subjected to a cyclic thermal treatment, each cycle including heating to 170°C. The resulting dislocation structure was studied by electron transmission microscopy. Intrinsic dislocation loops were found after less than 10 cycles. After less than 4 cycles all loops were prismatic. After 4 cycles 80% of the loops were Frank sessile, which fraction then decreased with increasing number of cycles. The result is interpreted as due to a cyclic "vacancy pump" effect of the dislocation loops. Author (NSA)

N69-27352# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
STUDIES IN THE CORROSION OF ALUMINIUM BASE ALLOYS IN WATER AT VARIOUS pH VALUES PART 2: CORROSION OF DISPERSION HARDENED ALUMINIUM CONTAINING ALUMINA AND ALUMINIUM BASE MANGANESE, NICKEL AND IRON ALLOYS
P. R. Shibad, N. S. D. Elayathu, and J. Balachandra 1968 9 p refs
(BARC-378) Avail: CFSTI

The influence of pH on the corrosion of dispersion hardened aluminum containing 4, 5 and 7% alumina and Al-1% Mn-0.7% Fe and Al-1% Ni-0.7% Fe alloys in water of pH 5, 6.5 and 8 at 30°, 85° and 100°C was studied by weight loss and electrochemical methods. The corrosion rates of the dispersion hardened aluminum containing 4, 5 and 7% Al_2O_3 are in general higher than those of Al-1% Mn-0.7% Fe and Al-1% Ni-0.7% Fe alloys. While the corrosion process control in water of pH 8 at 30°C is essentially anodic for dispersion hardened aluminium specimens that for Al-1% Mn-0.7% Fe and Al-1% Ni-0.7% Fe alloys is cathodic. The results obtained were compared with those of aluminium base silicon, nickel and magnesium and A11S alloys. Author

N69-27368# Mound Lab., Miamisburg, Ohio.
A STATISTICAL EVALUATION OF POWDER CHARACTERISTICS MEASURED WITH THREE SYSTEMS
A. D. Grandillo 28 Feb. 1969 27 p
(Contract AT(33-1)-Gen-53)
(MLM-1580) Avail: CFSTI

Particle sizes of powder samples were statistically analyzed using data from three systems, a Coulter Counter, a sedimentation balance (Sedibal), and a Fisher Sub-Sieve Sizer. It was concluded that the particle size distributions obtained from the Coulter Counter and Sedibal are log normal. It was also concluded that the weight fraction distribution is not a probability distribution, but is a weight fraction-in diameter relationship, which is functionally related to the probability function defining the number-fraction data. A statistical model was derived which showed that the average specific surface is a function of the parameters of the number fraction distribution. Author (NSA)

N69-27436# Commissariat a l'Energie Atomique, Grenoble (France).
POINT DEFECTS IN IRON
H. Bilger, V. Hivert, J. Verdone, J. L. Leveque, and J. C. Soulie [1968] 18 p refs Presented at Conf. on the Phys. of Metals, Berlin, 18-23 Mar. 1968
(CEA-CONF-1030; CONF-680322-2) Avail: AEC Depository Libraries

Studies were made of the annealing of defects in iron, using measurements of electric resistivity, stored energy, rigidity modulus, internal friction, and magnetic after-effect. The defects were introduced into the iron by irradiation with electrons or neutrons, and the effects of impurities were studied. The types of defects responsible for each annealing stage are discussed. NSA

N69-27468# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

TREATMENT OF BREEDER REACTOR FUELS. ATTACK OF STAINLESS STEEL CANS BY HF-O_2 MIXTURES AND FUEL OXIDATION [TRAITMENT DES COMBUSTIBLES DES REACTEURS SURREGENERATEURS ATTAQUE DES GAINES EN ACIER INOXYDABLE PAR LES MELANGES HF-O_2 ET OXYDATION DU COMBUSTIBLE]

M. Bourgeois, J. P. Cuer, and B. Cochet-Muchy [1968] 25 p refs In FRENCH Presented at the Symp. on Nonaqueous Reprocessing, Mol, Belgium, 28 Oct. 1968

(CEA-CONF-1198; CONF-681040-2) Avail: AEC Depository Libraries

Studies were made on the attack of stainless steel by the mixture HF–O, treatment of pellets of UO_2 frits by the mixtures HF–O and O–N, and decladding and pulverization of UO_2 fuels clad with stainless steel. Results on reaction mechanisms showed that stainless steel is only slightly attacked if the reagents HF and O_2 are passed through successively. The effects of the mixture HF–water vapor were identical to that of pure HF. The pulverization of pellets of UO_2 frit and their transformation require at 600°C a treatment of $1\text{-}1/2$ hours by the mixture O–N containing 55% O. Decladding of the samples required 1 hr 15 min to 1 hr 30 min., which showed the reproducibility of the openings of the cans. The temperature used for decladding was 20 to 80°C; and 40°C for pulverization. NSA

N69-27481# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

FILM CONDENSATION OF LIQUID METALS: PRECISION OF MEASUREMENT

Stanley J. Wilcox and Warren M. Rohsenow Apr. 1969 122 p refs

(Contract NSF GK-1113)

(DSR-71475-62) Avail: Issuing Activity

An error analysis is presented, that indicates the reported pressure dependence of the condensation coefficient at higher pressures is due to an inherent limitation in the precision of the condensing wall temperature measurement. The analysis shows, that the primary variable affecting the precision of the wall temperature measurement is the thermal conductivity of the condensing block. To verify the analysis, potassium was condensed on a vertical surface of a copper condensing block. The copper block was protected from the potassium with nickel plating. Condensation coefficients near unity were obtained. These experimental results agree with the prediction of the error analysis. A discussion of the precautions used to eliminate the undesirable effects of both non-condensable gas and improper thermocouple technique is included. It is concluded from the experimental data and the error analysis that the condensation coefficient is equal to unity and that the pressure dependence reported by others is due to experimental error. Author

N69-27495# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

PROTECTION OF ZIRCONIUM AND ITS ALLOYS BY METALLIC COATINGS [PROTECTION DU ZIRCONIUM ET DE SES ALLIAGES PAR DES REVETEMENTS METALLIQUES]

Henri Loriers, Alain Lafon, Raymond Darras, and Pierre Baque Oct. 1968 20 p refs In FRENCH

(CEA-R-3612) Avail: AEC Depository Libraries

Metallic coatings to protect Zr and Zr–alloy fuel cladding at 600°C in a CO_2 environment were tested. Coatings of Al and Cu proved to be unsatisfactory. However, Cr and Mo coatings produced desired effectiveness and film adherence to the Zr. NSA

N69-27619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FATIGUE STRENGTH OF HIGH-STRENGTH STEEL

V. G. Krupin 14 Nov. 1968 8 p refs Transl. into ENGLISH from the Conf. Rept. "Soveshchaniye po Ustalosti Metallov. 4th Prochnost Metallov Pri Tsiklicheskikh Nagruzkakh. Materialy" Moscow, Izd-Vo Nauka, 1967 p 147–151

(AD-684009; FTD-HT-23-783-68) Avail: CFSTI CSCL 11/6

The steel studied was stainless ribbon 0.09 to 0.20 mm thick having the % composition 0.24 C, 0.80 Si, 0.80 Mn, 14.5 Cr, 4 Ni, 2.8 Mo, 0.06 N2 and coldhardened by deforming to 83%. It was found that it has low static notch sensitivity (lower than that of heat-treated steels), that static strength is raised appreciably by increased cold plastic deformation, and that its fatigue strength is raised substantially by mechanical polishing. Author (TAB)

N69-27631# Naval Civil Engineering Lab., Port Hueneme, Calif.

CORROSION OF MATERIALS IN HYDROSPACE. PART 5: ALUMINUM ALLOYS

Fred M. Reinhart Jan. 1969 89 p refs

(AD-683334; N-1008-Pt-5) Avail: CFSTI CSCL 13/8

A total of 900 specimens of 40 different aluminum alloys were exposed at depths of 2,500 and 6,000 feet in the Pacific Ocean for periods of time varying from 123 to 1064 days in order to determine the effects of deep ocean environments on their corrosion resistance. Corrosion rates, types of corrosion, pit depths, stress corrosion cracking resistance, changes in mechanical properties and compositions of corrosion products are presented. Author (TAB)

N69-27552# Oak Ridge National Lab., Tenn.

METALLOGRAPHIC PREPARATION OF ARC-CAST THORIUM CARBIDES AND CORRELATION OF THEIR MICROSTRUCTURES WITH COMPOSITION

Mildred Bradley Sears, T. M. Kegley Jr., Leslie M. Ferris, and B. C. Leslie Mar. 1969 41 p refs

(Contract W-7405-eng-26)

(ORNL-4354) Avail: CFSTI

Arc-cast thorium carbide specimens with C/Th atom ratios varying from 0.8 to 2.1 (4.0 to 10.0 wt % carbon) were prepared for metallographic examination, and their microstructures were correlated with the chemical analyses, the x-ray diffraction analyses, and the products of hydrolysis. The thorium monocarbide phase was found to exist over a range of composition from about $ThC_{0.94}$ (4.6% carbon) to at least as low as $ThC_{0.81}$ (4.0% carbon). Specimens with compositions from $ThC_{0.99}$ to $ThC_{1.88}$ (4.8 to 8.8% carbon) were two phase mixtures of the mono- and dicarbides at room temperature. The maximum combined C/Th atom ratio obtained by arc melting with graphite electrodes was 1.96 (9.2% carbon). There was no evidence for any significant range of composition for the dicarbide at room temperature. A new metallographic procedure with several advantages over air-etching contributed significantly to the study. Author (NSA)

N69-27670# Bureau of Mines, Reno, Nev. Metallurgy Research Center.

PREPARATION OF THORIUM METAL BY VACUUM DISTILLATION OF ELECTRODEPOSITED THORIUM-CHROMIUM AND THORIUM-MANGANESE ALLOYS

James E. Murphy, E. Morrice, and M. M. Wong Jun. 1969 11 p refs

(BM-RI-7285) Avail: Issuing Activity

High-purity thorium metal was prepared from electrolytically produced thorium alloys. The thorium-chromium and

thorium-manganese alloys were separated into the component elements by vacuum distillation. Chromium and manganese impurities remaining in the thorium metal after distillation at 1,850°C were <0.005 weight-percent. Removal of volatile impurities such as aluminum, calcium, magnesium, and lead was also accomplished. Author

N69-27579# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material-und Festkoerperforschung.
VAPOR CHROMIUM PLATING OF UO SUB 2 AND AI SUB 2 O SUB 3 PELLETS [DIE ABSCHEIDUNG VON CHROM AUF UO_2 UND AL_2O_3 KUGELN AUS DER GASPHASE]
H. Schneider and D. Schoenwald Jul. 1968 20 p refs In GERMAN
(KFK-787; EUR-3959.d; EURFNR-572) Avail: CFSTI

A method for chromium carbide and metal chromium plating of UO_2 and Al_2O_3 pellets in a fluidized bed is described. Heat decomposition of dicumenechromium without a catalyst yielded chromium carbide (Cr_7C_3) coatings with approx. 10% C, the vapor-deposited chromium on batches of 50 g Al_2O_3 amounting to up to 20 vol %. When iodine was used as a catalyst, heat decomposition of dicumenechromium yielded metal chromium platings containing up to 0.05% C. In this case, up to 34% vol % chromium was vapor-deposited on batches of 50 g UO_2 pellets. The platings obtained by the two techniques were of good quality, thick, even, and with a metallic shine. X-ray and chemical analysis revealed no impurities apart from carbon. The coated particles are used to make UO_2–Cr cermets with idealized structures. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-26197# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROPERTIES OF PLASTICS AT LOW TEMPERATURES
V. A. Levin, P. G. Naumenkov, and M. V. Shchitov 29 Jul. 1968 8 p refs Transl. into ENGLISH from Plasticheskie Massy (USSR), no. 11, 1966 p 64–65
(AD-683111; FTD-HT-23-374-68) Avail: CFSTI CSCL 11/9

The strength characteristics of several plastics were determined in the +20 to -196C temperature range. The plastics examined were: (1) fiberglass SVAM with BF-4 binder; (2) SVAM with epoxy 1200; (3) fiberglass KAST-V with BF-4 binder; (4) textolite PT; and, (5) polyvinylchloride. There was no change in flexural strength (according to GOST 4648-56) in 4 and 5; 1 and 2 reached maxima and delaminated. All the materials showed gradual increase in Brinell hardness with decreasing temperature (GOST 4670-62). There was almost no change in impact strength (GOST 4647-55) in 4 and 5; the fiberglasses reached maxima in the -30 to -60C region before delamination. Tensile strengths (GOST 4649-55) of 4 and 5 were reduced 10-15% on repeated freezing; the delamination in the others was more pronounced the lower the temperature. Shear strength (GOST 10044-38) of 1, 2, and 3 increased sharply, with 1 and 2 reaching maxima at -80 to -100C; 5 went through a sharp maximum at about -100C, and the shear strength of 4 increased to about -30C and then decreased gradually. Some of these materials may be used under cryogenic condition. Author (TAB)

N69-26228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMERS AND PLASTICS
M. G. Dranovskii 31 Oct. 1968 8 p Transl. into ENGLISH from Mashinostr. (Kiev), no. 9, 1967 p 8–9
(AD-683960; FTD-HT-23-905-68) Avail: CFSTI CSCL 11/9

The report highlights the second Conference on the use of plastics in mechanical engineering was held in Moscow in January 1967. Topics covered included: use of new polymetric materials and plastics; introduction of new designs; mastering of new processing equipment. The Conference stressed progress achieved in the fields of the mechanics of polymers, strength calculation of parts, and studies of the physical and mechanical properties of polymers. The Conference noted certain shortcomings of the USSR plastics industry: inadequate use of plastics in mechanical engineering, poor quality of materials, absence of standard specifications for certain materials, insufficient training of specialists, and absence of a leading scientific-research organization responsible for the quality of polymeric materials and their use in mechanical engineering. TAB

N69-26352*# Denver Research Inst., Colo. Industrial Economics Div.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Evaluation Report, 13 Oct.–12 Dec. 1968
Theodore D. Browne, R. O. Morgan, Dean R. Lessley, William M. Hildred, and George E. Hayo 13 Dec. 1968 67 p refs
(Contract NSR-06-004-063)
(NASA-CR-101103; QR-4) Avail: CFSTI CSCL 11I

Instances of information usage investigated under the project for the analysis of technology transfer (PATT) are reported. Case studies are presented which represent the final screening of questionnaires returned by technical support package requestors during the first year of the project. Author

N69-26448*# Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT AND PROCESSING OF PYRONNE POLYMERS
L. E. Karre, L. B. Keller, and L. J. Miller Washington NASA May 1969 105 p refs
(Contract NAS1-6287)
(NASA-CR-1310; P68-148) Avail: CFSTI CSCL 07C

This report describes the development and processing of polymers formed from the condensation reaction of aromatic dianhydrides with aromatic tetraamines in various solvents. In Phase I, the primary efforts involved the synthesis and characterization of the polymer formed from the condensation of pyromellitic dianhydride (PMDA) with diaminobenzidine (DAB) in polar solvents and the subsequent preparation and testing of fabricated articles. In Phase II, primary efforts included the synthesis, characterization, and subsequent fabrication of the polymer formed from the condensation of benzophenone tetracarboxylic dianhydride (BTDA) with diaminobenzidine (DAB) in the esterifying solvent ethylene glycol (EG). Phase III of the program was directed toward laminates fabricated from the polymer formed from the condensation of BTDA with DAB in the esterifying solvent ethanol (EtOH) had flexural strength above 70,000 psi and moduli above 3×10^6 psi, but more important, the thermal stability was greatly improved. The most promising resin system of the three investigated, from the standpoint of both mechanical strength and thermal stability, is the polymer formed from BTDA and DAB in ethanol. Author

N69-26589# Princeton Univ., N.J. Frick Chemical Lab.
CHARACTERIZATION OF POLY(DIMETHYL SILOXANE)-POLYCARBONATE BLOCK COPOLYMERS

M. Narkis and Arthur V. Tobolsky Jan. 1969 21 p refs
(Contract N00014-67-A-0151)
(AD-683671; ONR-TR-RLT-114) Avail: CFSTI CSCL 11/9

Shear modulus-temperature curves and swelling behavior of poly(dimethyl siloxane)-bisphenol-A polycarbonate block copolymers were studied. Two glass transitions corresponding to the silicone and polycarbonate phases are found. The dependence of one phase transition on the presence of the second phase is discussed. A correlation of the shear modulus between the two glass transitions and the swelling ratio of the rubbery phase is suggested. Author (TAB)

N69-26637# Los Alamos Scientific Lab., N.Mex.
SPECIALIZED HIGH-PERFORMANCE COATINGS
S. E. Newfield, E. E. Eaton, and E. P. Ehart 22 Jan. 1969 8 p refs
(Contract W-7405-ENG-36)
(LA-4060) Avail: CFSTI

Several specialized coatings have been used where good performance is required under extreme conditions, including cryogenic and elevated temperatures, corrosive environments, wear, friction, and radiation. Successful applications of various commercial and locally formulated coatings are discussed. Author (NSA)

N69-26946 Alfred Univ., N.Y.
THE ELECTRONIC PROPERTIES AND CATALYSIS ON TiO_2
Robert Stanley Cichowski (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16617

The thermally stimulated current technique for the analysis of the energy level distribution in the band gap was uniquely applied to an anatase powder. The research represents the first time that this semiconductor technique has been used to study the electronic constitution of the surface of a catalytic material. A variation of the TSC technique, known as the photoelectret effect method, was also successfully applied to anatase. In some instances a thermally stimulated current was developed above room temperature without prior excitation of the sample. Subsequent experiments with various gases irreversibly adsorbed at room temperature showed gas desorption above room temperature was responsible for the currents. There appears to be potential for further desorption studies using this method. The TSC data show the possibility of six or more electronic energy levels for a very pure anatase powder; while, 1%Nb-doped anatase perhaps has three additional levels. Dissert. Abstr.

N69-26958# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIBER GLASS PLASTIC OBTAINED FROM POLYESTER EPOXY BINDER BY THE CONTACT METHOD AT NORMAL TEMPERATURES
L. I. Kravchenko et al 30 Jul. 1968 17 p refs Transl. into ENGLISH from Plasticheskie Massy (Moscow), no. 3, 1966 p 28–32
(AD-683083; FTD-HT-23-375-68) Avail: CFSTI CSCL 11/9

Fiberglass plastic containing 60-65% resin was obtained from a polyester epoxy resin and benzoyl peroxide-dimethyl aniline - Co linoleate system. Polymerization of a polyester epoxy resin with isopropylbenzene hydroperoxide-Co linoleate or benzoyl peroxide-dimethyl aniline systems gave fiberglass plastics with inferior physical properties. TAB

N69-26961# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF STRESS ON EQUILIBRIUM TEMPERATURE OF SELF-HEATING OF PLASTICS DURING CYCLIC LOADING
S. B. Ratner et al 8 Nov. 1968 9 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR), no. 1, 1967 p 179–182
(AD-683956; FTD-HT-23-813-68) Avail: CFSTI CSCL 11/9

Experiments on cyclic loading of vinylplast, organic glass, kapron polystyrene, and resin PN-1 showed that the steady-state temperature has been described. TAB

N69-27002# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF PLASTICIZERS ON ADHESION OF COATINGS IN THE AGING PROCESS
V. A. Zubchuk et al 18 Nov. 1968 15 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i ikh Primenenie (Leningrad), no. 1, 1967 p 10–14
(AD-684000; FTD-HT-23-802-68) Avail: CFSTI CSCL 11/3

The effects of plasticizers such as dibutylphthalate, tricresylphosphate, and chlorinated biphenyl on degradation of coatings based on chlorinated poly vinyl chloride in the process of radiation aging and on drop in adhesion in this process were studied. Two layers of the material studied together with a basic layer were laid on a film. Adhesion was detected periodically for 8 months by the method of detaching a plastic film from the sample reinforced by glass fibers. The degree of adhesion destruction was detected from the IR spectra according to a change in optical density of corresponding absorption bands. TAB

N69-27003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL EVALUATION OF THE EFFECT OF TRANSVERSE DISPLACEMENTS DURING BENDING OF PLATES MADE FROM ANISOTROPIC FIBERGLASS-REINFORCED PLASTICS
Yu. M. Tarnopol'skiy et al 28 Aug. 1968 10 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 1, 1967 p 146–150
(AD-683101; FTD-HT-23-560-68) Avail: CFSTI CSCL 11/9

Results of experiments on square freely-supported plates of anisotropic fiberglass-reinforced plastics are given. The results obtained are compared with calculation formulas that are based on hypotheses that are less strict than the Kirchhoff-Love hypothesis. Author (TAB)

N69-27021 Stanford Univ., Calif.
HIGH TEMPERATURE CREEP OF POLYCRYSTALLINE SODIUM CHLORIDE
Peter McLauchlin Burke (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-15033

The steady state creep behavior of polycrystalline sodium chloride of greater than 99 percent theoretical density was determined by constant stress compression testing. The grain size ranged from 200 to 3000 microns; the test temperature, from 365°C to 741°C. Steady state creep in sodium chloride, as in metals, occurs by a dislocation glide and climb mechanism and by grain boundary sliding. Subgrains form during creep, and the steady state creep rate is independent of grain size. The subgrain size is inversely proportional to the applied stress. At temperatures above about 530°C, the creep rate is controlled by chlorine diffusion through the lattice, and the activation energy for creep is 49 ± 6 kcal/mole or 2.1 ± 0.2 eV. Below 530°C, the creep rate is controlled by dislocation enhanced chlorine diffusion, and the activation energy for creep is 37 ± 6 kcal/mole or 1.6 ± 0.2 eV. Dissert. Abstr.

N69-27157# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF FIBER CURVATURE ON ELASTIC PROPERTIES OF UNIDIRECTIONALLY REINFORCED PLASTICS

A. V. Nosarev 7 Nov. 1968 11 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 5, 1967 p 858–863

(AD-683543; FTD-HT-23-663-68) Avail: CFSTI CSCL 11/9

The paper develops an approximate method of determining reduced elastic constants of fiberglass-type reinforced plastics with consideration of fiber curvature for the plane state of stress. Tests run on model specimens to confirm the theoretical conclusions show good agreement for five of six specimens. Author (TAB)

N69-27183*# Los Alamos Scientific Lab., N.Mex.

CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Report, 1 Feb.–30 Apr. 1969

Morton C. Smith 13 May 1969 33 p refs

(NASA Order W-12959; Contract W-7405-ENG-36)

(NASA-CR-101176; LA-4171-MS; PR-9) Avail: CFSTI CSCL 11B

A description of Santa Maria coke and its potential usefulness as a filler material in the manufacture of graphites and isotropic, high expansion carbons is given, including its source, availability, and price. It is commercially available as either green or calcined coke of uniform structure and quality. Chemical and screen analyses are presented in tabular form for both green and LV (low volatiles) calcined coke; the effects of heat treatment and grinding on the crystalline parameters are examined. The manufacturing conditions for hot molded graphites made from Santa Maria fillers and the properties of the finished graphites are reported for green coke fillers, fillers vacuum-calcined at 900°C and calcined in helium at 1300° and 1500°C, fillers graphitized at 2600° and 2800°C, and LV coke fillers. A discussion on resin-bonded graphites, extruded graphites, and solvent blending experiments is included. Summaries concerning other carbon and graphite research and development are supplied in the areas of fluid-energy grinding conditions, graphite binders, high temperature mechanical properties, and materials characterization. P.A.B.

N69-27315# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF SILICON-ORGANIC SIZERS ON THE PHYSICOCHEMICAL PROPERTIES OF GLASS-REINFORCED PLASTICS

V. I. Alksne et al 7 Nov. 1968 14 p refs Transl. into ENGLISH from Mekhan. Polimerov (Moscow), no. 5, 1967 p 787–794

(AD-684007; FTD-HT-23-682-68) Avail: CFSTI CSCL 11/9

Properties of polyester-resin specimens studied as functions of sizer were: ultimate static bending strength, water uptake, and degree of binder polymerization, in the dry specimens and after 30 days of soaking in water. It was found that sizers capable of reacting chemically with the resin or increasing its polymerization improve mechanical properties, and that sizer-binder chemical reactions increase dry bending strength, lower wet strength and water absorption, and promote polymerization. Author (TAB)

N69-27361*# Westinghouse Research Labs., Pittsburgh, Pa.

SYNTHESIS OF PYRRONE POLYMERS, 21 June 1967–21 JUNE 1968

L. W. Frost and G. M. Bower Jun. 1968 7 p refs

(Contract NAS1-7354)

(NASA-CR-66693) Avail: CFSTI CSCL 11I

When pyrrone prepolymers are prepared by the reaction of a dianhydride and a tetramine in a polar aprotic solvent, some chain branching occurs, and gelation is difficult to avoid. In this study stable solutions of linear prepolymers have been prepared by substituting various diacetamido diamines for the tetramines. Satisfactory laminates were prepared from one of these polymers, although film casting attempts failed. Infrared and TGA studies showed that a 150°C cure converts the prepolymer to a polyimide, which is quite stable at 300°C. Some conversion to the pyrrone occurs at 350-400°C, although it is far less complete than for polymers derived from tetramines. When preparing prepolymer from a dianhydride and a tetramine, it was found that addition of triethylamine or other bases reduced the gelation tendency and permitted an increase of polymer concentration from 10 to 16%. Acids accelerated gelation. Poor laminates were obtained from these solutions. Solutions of low molecular weight polymers up to 30% solids were obtained by the reaction of tetramines with diester diacids. Author

N69-27363# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

PERFORMANCE AND AREAS OF APPLICATION OF NEW RADIOPHOTOLUMINESCENT GLASSES [PERFORMANCES ET DOMAINES D'APPLICATIONS DE NOVEAUX VERRES RADIOPHOTOLUMINESCENTS]

Anne Marie Chapuis, Paul Sigli, Henri Francôis, Nicole Nicodeme, Serge Carpentier et al 1968 9 p refs In FRENCH; ENGLISH summary Presented at Intern. Symp. on Nucl. Electron. and Radioprotection, Toulouse, 4 Mar. 1968

(CEA-CONF-1099; CONF-680302-9) Avail: AEC Depository Libraries

Five new radiophotoluminescent glasses, whose compositions are covered by patents, were investigated. The glasses contain, in varying ratio, $LiPO_3$ $Be(PO_3)_2$, $NaPO_3$, $Al(PO_3)_3$, and $AgPO_3$. The sensitivity of the glasses to γ radiation, x radiation, thermal neutrons, fast neutrons, and protons at 3 GeV was investigated. The mean predose of the glasses (the intensity of the fluorescence measured on a dosimeter before any irradiation) was determined for the five glasses. NSA

N69-27526# Oak Ridge National Lab., Tenn.

PERFORMANCE AND STABILITY OF BOROSILICATE GLASSES DURING ROLLING OF STAINLESS STEEL URANIUM DIOXIDE FUEL COUPONS

W. R. Martin and J. M. Jones Feb. 1969 27 p

(Contract W-7405-eng-26)

(ORNL-TM-2417) Avail: CFSTI

The incorporation of boron in the form of borosilicate glass for burnable poison in UO_2 stainless steel dispersion plates was studied. Fragmentation and stringering of the glasses during rolling varied with both glass composition and rolling temperature. Glass beads rolled much better than irregular particles of the same composition. Boron retention capability of the glass varied also. Corning code 7230 glass beads showed excellent boron retention in plates rolled at 1100°C. The glasses were chemically compatible with both stainless steel and UO_2. Author (NSA)

N69-27649# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ENVIRONMENTAL STRESS CRACKING OF 10 LITER POLYETHYLENE BOTTLES

J. H. Kleinpeter 12 Jun. 1968 15 p refs

(Contract AT(45-1)-1830)

(BNWL-CC-1681) Avail: CFSTI

The causes of failures in 10 liter polyethylene bottles used to ship and store plutonium nitrate were investigated to determine ways to eliminate the problem. The failures were found to be caused primarily by environmental stress cracking due to excessive pressure in the bottles and can best be eliminated by limiting the

maximum total internal pressure to 10 psig. In addition the bottle quality should be specified as to material density and wall thickness. A redesign of the bottle to provide a hemispherical bottom is also recommended. NSA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-26185 Washington Univ., Seattle.
ON A COEFFICIENT PROBLEM IN UNIVALENT FUNCTIONS
Dean Gifko Phelps 1968 47 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17200

The main objective is the determination of the region occupied by the points (A_2,A_3,A_4) where A_2, A_3, and A_4 are the coefficients of z^2, z^3, and z^4 in the power series expansion about the origin of a function f(z), which is regular and univalent in the unit disc and normalized by the condition that $f(0) = 0$ and $f'(0) = 1$. The problem is limited to those functions for which A_2, A_3, and A_4 are real so the region will be in real three-dimensional space. The region is shown to be homeomorphic to the closed full three-dimensional sphere. The General Coefficient Theorem suggests that certain quadratic differentials are appropriate in the study of the problem. A family, F, of functions related to the quadratic differentials is shown to exist. A proof is given that the points (A_2,A_3,A_4) which correspond to functions of F are boundary points of the region and conversely that each boundary point of the region is associated with a unique function from F. Dissert. Abstr.

N69-26208 California Univ., Los Angeles.
THE CLASS OF K-FUNCTIONS ON RIEMANNIAN SPACES
Samuel George Councilman (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16524

A review of this work, with the added feature of indicating how it can be adapted to the more general setting of arbitrary ends in Riemannian spaces is presented. At the same time specialization is introduced so as to obtain K-functions. Additional properties of the normal operators, already known for dimension 2, but not previously considered for general Riemannian spaces, are obtained. In particular a crucial reproducing property is given. This is immediately useful in demonstrating the consistency of the normal operators L_λ. In analogy with the Poisson kernal representation for the Dirichlet operator, Sario has shown that his normal operators L_λ on Riemann surfaces also possess integral representations. It is proved that this property can be generalized to Riemannian spaces. The integral representations then enable one to formulate the main existence theorem in terms of a Fredholm integral equation. Dissert. Abstr.

N69-26209 University of Southern Calif., Los Angeles.
SYNTHETIC THEORY OF INDEFINITE METRIC SPACES
John Kelly Beem (Ph.D. Thesis) 1968 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-17013

The theory of G-spaces has shown that metric differential geometry is largely amenable to an axiomatic, purely geometric treatment, which is particularly effective in non-Riemannian spaces and leads to attractive novel problems related to the foundation of geometry. A similar approach has been used by Busemann and Beem to study indefinite metric spaces in a paper *Axioms for Indefinite Metrics*. A general G-space is a space satisfying the axioms given in this paper. The (indefinite) distance from x to y is denoted by xy. We begin by a study of the Minkowskian spaces. Let A^n denote the n-dimensional real affine space. If the general G-space R is taken as A^n and $xy = 2xw - 2wy$ whenever $w = 1/2\ (x + y)$, we call R a Minkowski space. If z denotes the origin the unit sphere K in R is $|x \mid xz = 1|$. The light cone C is $|x \mid xz = 0|$. Dissert. Abstr.

N69-26212# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
AN APPROACH TO THE PARAMETER ADAPTIVE CONTROL PROBLEM
George N. Saridis and Gunter Stein Dec. 1968 183 p refs
(Contract N00014-67-A-0226)
(AD-683692; TR-EE-68-35) Avail: CFSTI CSCL 12/1

The report presents an approach to the design of adaptive controllers for digital control problems involving linear stochastic systems with unknown parameters and performance indices which are quadratic functions of the state and control variables. The method is based upon two approximate solutions of the dynamic programming equation which is associated with the adaptive control problem. One solution constitutes an upper bound on the optimal cost of the adaptive control process, and the second solution constitutes a lower bound on the optimal cost. The upper bound leads to a control system which is linear in the state estimates and which realizes an actual operating cost less than or equal to the upper bound. This linear control system is developed in detail for systems with parameters which assume only finitely many values. Its performance is illustrated with a simple example. Several extentions and variations of the basic approach developed in the thesis are also discussed. These include systems with correlated measurement noise, systems with Markov dependent parameters, a special non-adaptive controller configuration, and infinite time adaptive control processes. Author (TAB)

N69-26248*# Stanford Univ., Calif.
APPROXIMATING PROPERTIES OF LINEAR MODELS FOR INPUT-OUTPUT DESCRIPTIONS
Ernest Gunther Holzmann Washington NASA May 1969 153 p refs
(Grant NGR-020-073)
(NASA-CR-1319) Avail: CFSTI CSCL 12A

B. L. Ho's existence theorem states necessary and sufficient conditions for strict realizability that are satisfied only in ideal situations. Mathematical proof is given that good dynamical simulation is possible with linear models which represent partial, rather than minimal, realizations. The restrictions of B.L. Ho's theorem do not apply to partial realizations, and the class of partially realizable input-output descriptions is large enough for practical purposes. For any normal sequence of scalar Markov parameters, the transfer function of each partial realization is shown to lie on the diagonal of the E-array corresponding to the given sequence. The proof is based on the classical theory of the Padé approximation. Relevant parts of this theory are reviewed and developed in the report, including a new, stronger form of Padé's representation theorem. As a by-product of this research, a sharpened, computationally more efficient version of B. L. Ho's minimal realization algorithm was derived. Author

N69-26249 Carnegie-Mellon Univ., Pittsburgh, Pa.
SERIES AND PARALLEL ADDITION OF OPERATORS
William Niles Anderson, Jr. (Ph.D. Thesis)
1968 67 p
Avail: Univ. Microfilms: HC 3.80/Microfilm 3.00 Order No. 68-17606

Let A, B be Hermitian semidefinite operators on a finite dimensional space. Let A^+ denote the Moore-Penrose generalized inverse. The parallel sum of A and B, A:B, is defined by $A:B = A(A + B)B^+$. If A and B are non-singular, this reduces to $(A^{-1} + B^{-1})^{-1}$, which is the familiar formula for the impedance matrix of a parallel connection of n-port networks; A:B gives the correct answer even in the singular case. It is proved that the Hermitian semidefinite operators on a finite dimensional space form a partially ordered commutative semigroup under parallel addition. If P and Q are projections with ranges R(P) and R(Q) respectively, then the projection onto R(P) R(Q) is 2 P:Q. An inequality, called the series-parallel inequality, is obtained. Generalizations to non-symmetric operators and to Hilbert space are considered. Dissert.Abstr.

N69-26256# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
THE NUMBER OF SUBSPACES OF A VECTOR SPACE
Jay Goldman and Gian-Carlo Rota 28 Jan. 1969 18 p refs Prepared in cooperation with MIT
(Contract N00014-67-A-0298)
(AD-683687; TR-23) Avail: CFSTI CSCL 12/1

The number G sub n of subspaces of an n-dimensional vector space over GF(q) is studied by the symbolic calculus. This calculus provides a general technique for proving theorems in particular identities, involving the G sub n and the Gaussian coefficient (n, k). Examples include a recursion for the G sub n, an infinite product expansion for the Eulerian generating function of the G sub n, and a q-analog of the Pascal triangle for the (n, k). Author (TAB)

N69-26348# Joint Publications Research Service, Washington, D.C.
GAME VERSION OF THE OPTIMAL HALT PROBLEM
Ye. B. Dynkin *In its* Cybernetics and Regulation Theory 19 May 1969 p 1–7 refs (See N69-26348 14-05)
Avail: CFSTI

Two theorems are proposed to solve the condition: $M\sup_{\tau} |x_\tau| < \infty$. Under this condition the existence of the game value is proved, the optimal strategies are constructed, and some conditions of the existence of optimal strategies are derived. B.P.

N69-26350# Joint Publications Research Service, Washington, D.C.
TWO METHODS FOR FINDING THE EQUILIBRIUM POINTS OF CONCAVE n-PLAYER GAMES
S. I. Zukhovitskiy et al *In its* Cybernetics and Regulation Theory 19 May 1969 p 8–13 refs (See N69-26348 14-05)
Avail: CFSTI

Two algorithms are constructed for finding the normalized equilibrium point. The first of them is based on equivalence of the problem of finding the normalized equilibrium point to the problem of finding the saddle point of the function $(g(y), x-y)$ in the region $\Omega \times \Omega$. The second is a generalization of the method of steepest descent. A distinguishing feature of the second algorithm consists in a special selection of the direction of descent characteristic for the method fo simultaneous solution of the direct and dual problem of convex programming in which, along with the maximizing sequency, the Lagrange factors are found which figure in the formulation of the optimalness criterion. Finding the step size and smoothing and eliminating the possibility of zigzag motion are realized with the help of the parameters λ_k which satisfy the conditions $\lambda_k > 0$, $\lambda_k \to 0$, $\Sigma\lambda_k = \infty$, characteristic of the methods of generalized gradient descent. Author

N69-26361 Cornell Univ., Ithaca, N.Y.
SOME SYNTHESIS METHODS FOR ADJUSTABLE NETWORKS USING MULTI-VARIABLE TECHNIQUES
James Frederick Delansky (Ph.D. Thesis)
1968 119 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-16738

The synthesis of the class of adjustable networks which respond or adapt to an independent (with respect to frequency) real variable, or possibly several independent real variables, and which for fixed values of the variable elements respond as linear time invariant networks so that the usual steady-state frequency description of the network are valid, is considered. In general, variable networks with any number of ports can be considered. The synthesis methods for variable networks that are developed depend on an algebraic decomposition of an nxn real rational 2-variable matrix W(s,p) given by $W(s,p) = J(s) + H(s)\,(pI_k - F(s))^{-1}\,G(s)$, where J(s), H(s), F(s), and G(s) are real rational matrices of appropriate orders and the integer k is the minimum possible integer. This decomposition is related to a particular network configuration, the cascade load connection, and is shown to have effectively specified the load network to be a p dependent network and the coupling network to be an s dependent network. Both these networks are then synthesized by any possible one-variable methods, passive or active. Dissert. Abstr.

N69-26364# California Univ., Los Angeles.
NONLINEAR SMOOTHING THEORY AND APPLICATIONS
John Benedict Peller (Ph.D. Thesis)
1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-16568

The smoothing estimation problem is concerned with finding the best estimate of the value of some time-varying parameter such as the system state at some particular time t by acting on a set of related observations taken over a period of time beginning before t and ending after t. The quality of the estimate is judged according to some probabilistic criterion such as maximum likelihood or minimum variance. The parameter is described by a vector differential equation, possibly nonlinear, with a Gaussian white noise driving term. The measurements are related to the system state via some vector equation, possibly nonlinear, also containing a white noise driving term. By deriving a differential relationship involving the probability density function for the state, conditioned on all of the observations, and expanding its characteristic function, exact differential equations are derived for the smoothed expectation of an arbitrary function in terms of either smoothed expectations or filtered expectations. Known solutions to the linear smoothing problem are shown to be solutions to the above differential equations. Dissert. Abstr.

N69-26365 Johns Hopkins Univ., Baltimore, Md.
ON THE FIBERING OF NON-COMPACT SOLVMANIFOLDS WHICH HAVE LOW DIMENSION OR LOW RANK
Albert William Currier (Ph.D. Thesis)
1968 38 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16406

If G is an analytic group and if S is a closed subgroup with a finite number of components then G/S is a vector bundle over a compact manifold K/W, where K is a compact analytic group and W is a closed subgroup of K (Mostow, *Covariant Fiberings of Klein Spaces*). When G is solvable the quotient G/S is called a solvmanifold. In this case S is likely to have infinitely many components. The question is natural: is G/S a vector bundle over a compact solvmanifold? In Mostow's paper *The Extensibility of Local Lie Groups of Transformations and Groups on Surfaces*, all the 2 dimensional spaces G/S are obtained, and one sees by inspection

that the answer to the question is affirmative. In this dissertation the question is answered affirmatively for the 3-dimensional solvmanifolds and for the solvmanifolds with fundamental group the integers. The paper is broken up into many fairly easy lemmas. The methods employed include algebraic linear groups and elementary fiber bundle theory. Dissert. Abstr.

N69-26367 Rutgers Univ., New Brunswick, N.J.
STABILITY THEOREMS FOR LIE ALGEBRAS OF DERIVATIONS
Charles Bruce Hallahan (Ph.D. Thesis) 1968 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17776

Let A be a finite dimensional algebra over a field F, and let L be a completely reducible Lie algebra of derivations of A. F has characteristic zero unless stated otherwise. Existence of certain L-invariant subalgebras are shown in the following cases. If A is associative, then there exists an L-invariant Wedderburn factor. If A is a Lie algebra, then there exists an L-invariant Levi factor. If A is a solvable Lie algebra, then there exists an L-invariant Cartan subalgebra. An element x in A is called an L-constant if D(x) = 0 for all D in L. Uniqueness results relating L-invariant subalgebras in terms of automorphisms defined by L-constants are proven. In particular, if A is associative with radical R such that A/R is separable, R is L-invariant and F has arbitrary characteristic, than for any two L-invariant Wedderburn factors S and T there exists and L-constant r in R such that C_{1+Rr} (conjugation by the invertible element 1 − r) carries S onto T. The assumption that R be L-invariant is not needed when F has characteristic zero, but an example is given to show that this assumption cannot be dropped when F has characteristic different from zero. Dissert. Abstr.

N69-26368 California Univ., Los Angeles.
MULTIPLICATIONS ON MANIFOLDS
Jerome Alvin Kaminker (Ph.D. Thesis) 1968 59 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16548

Let M be an m-dimensional, compact, connected manifold. A product on M, with unit e ∈ M, is a map m: M × M → M such that M(x,e) = m(e,x) = x, for all x ∈ M. Spaces which admit products are called H-spaces. They are a generalization of topological groups. Two products, m amd m', are equivalent if m is homotopic to m' relative to M × e ∪ e × M. The property of being an H-space is characterized in terms of the existence of a cross section of the bundle p: HM → M, where HM is the set of maps homotopic to the identity, provided with the compact open topology. The equivalence classes of products are shown to be in 1-1 correspondence with the vertical homotopy classes of cross-sections, which take e to id_M. An exact sequence is described, and one of the terms is shown to be in 1-1 correspondence with the set of equivalence classes of products. The problem of classifying products in terms of the subset of HM to which the associated left translations belong is considered, and an algebraic criterion is given for determining if each equivalence class of products contains a product with left translations in some prescribed subset of HM. The case of a sphere is worked out in detail. Dissert. Abstr.

N69-26369 California Univ., Los Angeles.
A COMPARISON OF ABSTRACT COMPUTABILITY THEORIES
Carl Edward Gordon (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-16534

In recent years a number of theories of computability on sets other than the integers have been developed, and it was shown that search computability is equivalent to some known abstract notions of computability. The theory of Σ-definable functions on an admissible set, and the related theory of κ-recursive functions on a recursively regular ordinal κ were also studied previously. In this dissertation it is shown that a function on an admissible set is Σ-definable in that set if and only if it is search-computable in δE, ∈, where δE is a functional representing restricted quantification. Similarly, it is demonstrated that a function on a recursively regular ordinal κ is κ-recursive if and only if it is search-computable in bounded quantification and <. Also discussed is the following different approach: given a set B, a set R of relations on B, and a subset C (of distinguished elements) of B, the relations Montague-aleph$_0$-recursive in R from C are those relations Δ_1-definable in the language of simple type theory from the given relations and distinguished elements. The aleph$_0$ refers to the interpretation of the variables as hereditarily finite sets. It is shown that if B is an infinite set, R a finite sequence of relations on B, C a subset of B, and R a relation on B, then R is Montague-aleph$_0$-recursive in R from C if and only if R is search-computable in R from C. Dissert. Abstr.

N69-26385 Johns Hopkins Univ., Baltimore, Md.
ON THE METHOD OF STEEPEST DESCENT APPLIED ON THE SOBOLEV SPACES $H^k(X,Y)$
William Bernard Gordon (Ph.D. Thesis) 1968 63 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16420

Let X and Y be C^∞ Riemannian manifolds, with X compact and Y smoothly and isometrically embedded in $|R^q$. Let $H^k(X, |R^q)$ denote the Sobolev space of maps f: X → $|R^q$ whose k'th order derivatives are square summable. Let $H^k(X,Y) = \{f \in H^k(X, |R^q) \mid f(x) \in Y$ for almost all x in X$\}$. It is well known that if $2k > d(x)$, $H^k(X,Y)$ is a C^∞ submanifold of $H^k(X, |R^q)$. We say that a C^1 function F on $H^k(X,Y)$ satisfies Condition C if every sequence of maps $\{f_n\}$ in $H^k(X,Y)$ for which $|F(f_n)|$ is bounded and $\nabla F(f_n) \to 0$ contains a convergent subsequence. We say that F satisfies Condition H if every $f \in H^k(X,Y)$ is homotopic to critical point of F. Condition C implies Condition H if $f \geq 0$. Dissert. Abstr.

N69-26394 University of Southern Calif., Los Angeles.
DYNAMIC PROGRAMMING AND PARTIAL DIFFERENTIAL EQUATIONS
Edward Stanley Angel (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-17011

Mathematical descriptions of a great many physical phenomena result in boundary value problems. The numerical solution of these problems is seldom easy. For a linear partial differential equation on a square, the conventional finite difference techniques require the solution of N^4 linear algebraic equations. The efficient iterative methods for solving these algebraic equations presently available are somewhat difficult to use and may fail to be useful at all for either nonlinear boundary value problems or boundary value problems over irregular regions. The two methods introduced here use dynamic programming to solve the variational problem corresponding to the partial differential equation under consideration. For a linear partial differential equation, the variational problem is quadratic. The structure of this quadratic problem is such that it can be solved as a sequence of variational problems all of dimension one less than that of the original problem. Dissert. Abstr.

N69-26398 California Univ., Los Angeles.
A MAXIMUM LIKELIHOOD APPROACH TO PREDICTION AND ESTIMATION FOR NONLINEAR DYNAMIC SYSTEMS
Leland Dalton Attaway (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-16600

It is often desirable to estimate certain parameters, such as initial conditions, of a dynamic physical process using noise-corrupted observations. This dissertation describes a maximum likelihood solution when the process is time-invariant nonlinear and the observation is a linear combination of true process coordinates and noise. It is applied to a white gaussian noise case in which the initial conditions have a known a priori joint gaussian distribution and all other process parameters are known. It is desired to estimate the state $t \geq 0$, given continuous observation over (0,T) and a priori statistics. Given a maximum likelihood estimate of initial conditions, a natural estimate for the system state at $t > 0$ simply updates the process differential equation from the estimated initial conditions. The algorithm therefore estimates initial conditions. Dissert. Abstr.

N69-26411# RAND Corp., Santa Monica, Calif.
INVERSE FUNCTIONS OF THE PRODUCTS OF TWO BESSEL FUNCTIONS
William Sollfrey Feb. 1969 10 p refs
(Contract F44620-67-C-0045)
(AD-683256; RM-5886-PR) Avail: CFSTI CSCL 12/1

A simple, general method is given for calculating the inverse operator of the product of two spherical (or cylindrical) Bessel functions, as needed for input into an integral expression to determine atmospheric potential from signal phase shift. Author (TAB)

N69-26416# Iowa Univ., Iowa City. Dept. of Mathematics.
A NOTE ON COMPUTABLE REAL FIELDS
Eugene W. Madison Dec. 1968 8 p refs
(Contract N00014-68-A-0500)
(AD-683293; UI-TR-1) Avail: CFSTI CSCL 12/1

A general problem of interest in this area is the problem of finding a complete classification for the class of computable ordered real fields. This note contains two theorems in this direction. It has been shown by Lachlan and Madison that every computable ordered (arithmetically definable) real field is a proper subfield of the field of recursive (arithmetical) real numbers. The first result in this note establishes that any real-closed computable real field is a proper subfield of the field of arithmetical reals. The second result answers a question which arises naturally from an earlier theorem of M. O. Rabin which asserts that the algebraic closure of a computable field is always computable. It is proven in this note that the real-closure of a computable field need not be computable. This result may strike one as surprising since an obvious extension of a theorem of Lachlan and Madison is that the real-closure of any computable ordered field is computable. Author (TAB)

N69-26441# Oak Ridge National Lab., Tenn. Mathematics Div.
A SEQUENTIAL PROCEDURE FOR SELECTING THE POPULATION WITH THE SMALLEST VARIANCE FROM k NORMAL POPULATIONS
David G. Hoel Jan. 1969 17 p refs
(Contract W-7405-ENG-26)
(ORNL-4355) Avail: CFSTI

A technique is given for the construction of sequential selection procedures which are truncated and fully sequential. The method is applied to the problem of selecting the population with the smallest variance from a set of k normal populations. Author (NSA)

N69-26517# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
SOME EFFECTS OF ERRORS OF MEASUREMENT IN MULTIPLE CORRELATION
W. G. Cochran 27 Jan. 1969 27 p refs
(Contract N00014-67-A-0298)
(AD-683690; TR-25) Avail: CFSTI CSCL 12/1

In many multiple correlation and regression studies the values of the variables are difficult to measure accurately. This paper attempts to discuss the effects of such errors of measurements on the squared multiple correlation coefficient. Author (TAB)

N69-26545 State Univ. of New York at Buffalo
A SWITCHING ALGEBRA AND ASSOCIATED MINIMIZATION TECHNIQUES APPLICABLE TO THE DESIGN OF MULTIPLE-VALUED LOGIC SYSTEMS
Charles Michael Allen (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-17305

A multiple-valued algebra is introduced as a mathematical model for the study of switching circuits having two or more logic values. Various techniques for manipulating switching functions expressed in this algebra are presented. Some of these techniques are extensions of similar ones used to manipulate two-valued switching functions expressed in conventional Boolean algebra. In particular, a map method related to the Karnaugh map is presented. As in the two-valued case, the prime implicants of a function can be found directly from its map. An operation which is applicable to functions of any number of variables is introduced, based upon the concepts underlying the two-valued case, repeated use of this operation produces all the prime implicants of the switching function. Dissert. Abstr.

N69-26547 Texas Univ., Austin.
A STUDY OF THE MODAL PROPERTIES OF LINEAR DYNAMICAL SYSTEMS
Harold D. Albertson (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-16043

The problem of mode cancellation in the single-input, single-output, as well as the multivariable, system is considered. It is shown that mode cancellation in a single-input, single-output system necessarily results in an uncontrollable and/or unobservable system. This is not true for a multivariable system, however. The problem of constructing minimum-state realizations of transfer function matrices is considered in detail. This problem is solved for three cases where the elements of the transfer function matrix have simple, complex, and multiple poles. A solution to the problem of determining the minimum number of outputs required to observe all the dynamic modes of a system and the minimum number of inputs required to excite all system modes is presented. Algorithms for removing uncontrollable and unobservable modes from time-variable as well as constant parameter systems are developed. Dissert. Abstr.

N69-26552# Iowa Univ., Iowa City. Dept. of Mathematics.
ON CLASSES OF GRAPHS DEFINED BY SPECIAL CUTSETS OF LINES
Stephen Hedetniemi Jan. 1969 36 p refs
(Contract N00014-68-A-0500)
(AD-683295; UI-TR-3) Avail: CFSTI CSCL 12/1

A new method is given for studying graphs. Generally speaking this involves decomposing a graph into two disjoint subgraphs which are connected by special sets of lines. Four types of connections between these subgraphs are considered, i.e. those for which the set of connecting lines describes a function, a homomorphism, a permutation, or an automorphism. This manner of decomposing a graph is thought to be useful for studying a wide variety of parameters and properties of graphs. To illustrate this, results are obtained relating to such concepts as arboricity, thickness, biparticity, and chromatic number. A method is derived for constructing new classes of critical graphs, and several isomorphism theorems for classes of permutation graphs are given, one of which involves the group theoretic concept of a double coset. Author (TAB)

N69-26553# Iowa Univ., Iowa City. Dept. of Mathematics.
STRUCTURES ELEMENTARILY CLOSED RELATIVE TO THE NATURAL NUMBERS
Eugene W. Madison Dec. 1968 11 p refs
(Contract N00014-68-A-0500)
(AD-683294; UI-TR-2) Avail: CFSTI CSCL 12/1

The paper discusses certain model theoretic properties of computable structures (or arithmetically definable structures). In particular, it is shown that every arithmetically definable ordered subfield of real numbers is elementarily-closed relative to the natural numbers. Among the examples of fields which are not elementarily closed, we give an example of a subfield of complex numbers. It is shown that not every arithmetically definable field is elementarily closed. Author (TAB)

N69-26556# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SOME DISTRIBUTION-FREE RANKING AND SELECTION PROCEDURES
Gary Carl McDonald Jan. 1969 92 p refs *Its* Mimeograph Ser. 174
(Contract F33615-67-C-1244)
(AD-683754) Avail: CFSTI CSCL 12/1

The report deals with some nonrandomized distribution-free ranking and selection procedures using the subset selection approach. Chapter I begins by considering two classes of selection rules depending on a continuous, but otherwise arbitrary, distribution G. Chapter II discusses the distribution theory associated with the two distribution-free procedures under consideration. Chapter III compares some performance characteristics of the two procedures with those of possible competing procedures. TAB

N69-26557# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
INTERSECTION THEOREMS FOR POSITIVE SETS
Wolfhard Hansen and Victor Klee Jan. 1969 15 p refs Prepared in cooperation with Washington Univ. and Erlangen-Nuremberg Univ. *Its* Math. Note 587
(AD-683773; D1-82-0810) Avail: Issuing Activity CSCL 12/1

In a vector space over an ordered field, a positive set is one that is closed under the operation of forming linear combinations with nonnegative coefficients; it may be described alternatively as a convex cone whose apex is the origin. Such sets arise naturally as solutions of systems of homogeneous linear inequalities, and the intersection theorems proved here can be reformulated as consistency theorems for such systems. The main tool used in proving the intersection theorems is a characterization and classification of sets which enjoy a strong independence property with respect to the formation of nonnegative linear combinations. Author (TAB)

N69-26574# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
THE BOLTZMANN COLLISION INTEGRALS. PART 1: GENERAL ANALYSIS
Roddam Narasimha and Suresh Madhusudan Deshpande Nov. 1968 15 p refs
(ARC-TN-1) Avail: CFSTI

It is shown how, if the distribution function can be expressed as a sum of Maxwellians, three of the five integrations in the Boltzmann collision terms can be performed analytically. This analysis is valid for arbitrary intermolecular potentials. Author

N69-26577# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
HANDBOOK OF STRUCTURE. PART 1: POLYHEDRA AND SPHERES
Robert Edward Williams Oct. 1968 169 p refs *Its* Res. Commun. No. 75
(AD-683553; Douglas Paper-5321-Pt-1) Avail: Issuing Activity CSCL 12/1

The work comprises the first part of a series of descriptive handbooks on geometry and structure. It contains basic information on the following: (1) the five Platonic polyhedra, 13 Archimedian semi-regular polyhedra, and 13 Archimedian dual polyhedra; (2) a method for comparing surface areas and volumes of polyhedra; (3) a description of one system of basic subdivisions of the tetrahedron and the octahedron into smaller components; (4) infinite packings of circles in two dimensions and infinite packings of spheres in three dimensions; (5) polyhedra that may be defined by sphere packings; (6) methods of packing polyhedra in various combinations to fill space; (7) a method of accounting for volumes of polyhedra based on a tetrahedron with a normalized edge and a volume set at unity; and (8) methods of physically deriving polyhedra by various operations: folding the two dimensional net, cresting the dual of a polyhedron, truncating the vertices and edges of a polyhedron, rotating and translating polygon faces from one position to another, and fusing and separating vertices of polyhedra. TAB

N69-26590# MITRE Corp., Bedford, Mass.
ANALYSIS OF THE POLARIZATION SCATTERING MATRIX
W. T. Payne Dec. 1968 48 p refs
(Contract AF 19(628)-5165; ARPA Order 596)
(AD-683712; MTR-437; ESD-TR-67-627) Avail: CFSTI CSCL 12/1

It is shown how, by carrying out a sequence of three coordinate axis rotations in Poincare space, one can calculate the principal basis and the real, nonnegative eigenvalues of any symmetric polarization scattering matrix. Then the two eigenvalues and the three Eulerian angles of the principal axes in Poincare space constitute a complete set of pure scatterer parameters. A scatterer classification scheme based on these parameters is constructed, with the help of a geometrical representation, in Poincare space, of polarization transformations. The procedure is applied to several simple scattering configurations. Some conclusions are reached concerning the scatterer geometry in various cases. Author (TAB)

N69-26593# RAND Corp., Santa Monica, Calif.
PRIMAL RESOURCE-DIRECTIVE APPROACHES FOR OPTIMIZING NONLINEAR DECOMPOSABLE SYSTEMS
A. M. Geoffrion Dec. 1968 67 p refs
(Contract F44620-67-C-0045)
(AD-683723; RM-5829-PR) Avail: CFSTI CSCL 12/2

The optimization of large systems comprised of interrelated subsystems is considered. Three different methods are presented for decentralizing the optimization by partitioning into subsystems and iteratively allocating resources to the subsystems, followed by a coordination procedure. They are the Tangential Approximation method, the Large-Step Subgradient approach, and the Piecewise approach. All can be used with price-directive procedures, but resource-directive optimization has the advantages of primality. Author (TAB)

N69-26616 Carnegie-Mellon Univ., Pittsburgh, Pa.
A SEQUENTIALLY HOMING CONTENT-ADDRESSED MEMORY MODEL
William Murray Strome (Ph.D. Thesis) 1968 299 p
Avail: Univ. Microfilms: HC $13.60/Microfilm $2.85 Order No. 68-17646

A memory model has been developed in which the memory itself consists of a large number of multidimensional vectors whose directions define their information content and whose lengths define a measure of their accessibility. The basic access mechanism causes that vector to be read out which has the largest dot

product with a test vector, whose selection is controlled by the memory. The test vector is an estimate of the desired vector direction. The estimate is made on the basis of information obtained through previous (possibly erroneous) readouts, coupled with a performance measure supplied by the system's environment. A mechanism for altering the vectors imparts a learning capability to the model. The statistical properties (including probabilities, conditional probabilities, and expectations) of the spatial relationships between vectors are derived for the memory vector space. Dissert. Abstr.

N69-26622# California Univ., Los Angeles. Numerical Analysis Research.
PERIODIC FAMILIES OF SYSTEMS POSSESSING A FIRST INTEGRAL
Daniel Sweet 1968 28 p refs
(Contracts Nonr-233(76); DA-31-124-ARO(D)-355)
(AD-683742) Avail: CFSTI CSCL 20/11

Dynamical systems are considered which have a first integral. Nonlinear oscillation theory shows that these systems can frequently give rise to two-parameter families of periodic solutions. The standard approach to determine stability is to examine the characteristic multipliers of the linear variational equation of the family of periodic solutions under question. Now discounting the two unity multipliers that will automatically exist due to the parameters of the periodic family, the remaining multipliers can supply a stability criterion. If they are all in absolute value less than one, the family is stable and if at least one has absolute value greater than one, the family is unstable. Quite obviously if the remaining multipliers all have norm one (the characteristic exponents have zero real parts) the question of stability becomes more delicate since now the criterion becomes sensitive to the higher order terms. If our system were Hamiltonian, the characteristic exponents of our linear variational equation appear in negative pairs and so in this case one either concludes instability or one cannot tell. The report considers this critical case for a two degree Hamiltonian system and a stability criterion is developed for such a situation. Author (TAB)

N69-26658# Illinois Univ., Urbana. Dept. of Computer Science.
SPARSE MATRIX INVERSION ON ILLIAC 4
Yutaka Matsushita 24 Jun. 1968 40 p
(PB-180036; ILLIAC-4-193) Avail: CFSTI CSCL 09B

The inversion of a large (of order 500 to 1000) sparse matrix is discussed. This report describes an algorithm for the inversion of irregularly sparce matrices which are stored packed and with tags for the non-zero elements. The processing of giant sparse matrices is made difficult by the fact that only non-zero elements are stored in memory. This difficulty may be overcome by using the expand row routine and pack row routine. The algorithms for these routines and overall flow chart are shown for a simple example. Furthermore in order to reduce operation time, the scheme is used in which the operations are eliminated for the rows having zeros in the pivot column. Author (USGRDR)

N69-26672 Columbia Univ., New York.
TRANSCENDENTAL AND ALGEBRAIC POINTS ON GROUP VARIETIES
Allen Burchard Altman (Ph.D. Thesis) 1968 45 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16693

If A is an abelian variety defined over a number field K, there exists a quadratic function Q and a linear function L from A(K) to the real numbers such that the logarithmic height function h:A(K)→R, defined with respect to any closed immersion to projective space, is additively equivalent to the function Q+L. In this paper, a generalization of this asserts that the size function, which may be defined for an abelian variety defined over any field of characteristic 0, is bounded by a quadratic function. It is shown that the size function is independent of choice of generators of the field K up to multiplicative equivalence, and hence its multiplicative equivalence class is canonical. Properties of the height function on schemes are extended to the size function on schemes, at the same time eliminating the need for the normality of the schemes. Theorems on abelian varieties are used to prove that the hypotheses of the computational lemmas are satisfied. The parameterization of an exponential map of an abelian variety by means of suitable theta functions is extended to arbitrary commutative group varieties. It is proven that every commutative group variety G has a period matrix in normal form and that the constructed theta functions give an embedding of G in projective space. Dissert. Abstr.

N69-26678 Columbia Univ., New York.
CONTROLLED QUEUEING AND INVENTORY SYSTEMS
Eric Brodheim (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-16899

A class of queueing systems is considered for which the type of service provided and/or the customer arrival rate can be varied as a function of the number of customers in the system. A restricted, Markovian class of such systems, referred to as controlled queueing systems, can be represented as a series of interconnected random walks. Each random walk is between two reflecting barriers which have the property that the reflection need not be to the immediate adjoining state, as is usually the case. Using some general results derived for the above class of random walks, computationally feasible techniques are developed for analyzing the steady state behavior of controlled queueing systems and for calculating effectiveness measures associated with the operation of this type of system. Techniques are also developed for employing dynamic programming and Markov-Renewal programming to obtain optimal solutions for several types of problems. Dissert. Abstr.

N69-26688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIZING CIRCUITS MADE FROM THREE-VALUE MAJORITY ELEMENTS BY A METHOD OF SOLVING LOGIC EQUATION SYSTEMS
B. L. Ovsievich 30 Jul. 1968 17 p refs Transl. into ENGLISH from Avtomat. Vychis. Tekh. (Riga), no. 12, 1966 p 143–154
(AD-683117; FTD-HT-23-388-68) Avail: CFSTI CSCL 9/5

The majority decomposition of 3-valued-logic functions has been proposed as a method of synthesizing networks consisting of 3-stable majority elements. In general terms, this decomposition is a representation of a specified function through the operation of 3-valued majorization of three subfunctions. The solution of the logic-equation system is reduced to a solution of a system of linear inequalities with integer unknowns. The inequalities are solved by a new method which does not require integer linear programming. TAB

N69-26700 California Univ., Los Angeles.
THE STRUCTURE OF OPTIMAL FINAL VALUE CONTROL SYSTEMS
Charles Elwood Seal (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-16675

In this dissertation it is shown for linear single input minimum control, energy final value systems in phase variable canonical form that the order of the singularity in the feedback gain is inversely proportional to the derivative of the state being fed back, with the highest order singularity being of order N for an Nth order plant.

It is further shown for multiple input minimum control energy final value systems in multiple input phase variable canonical form, that each phase variable subsystem has the same singularity structure as a single input system of the same order. Also, the feedback cross coupling between subsystems may have gain singularities. If the cross coupling gain singularities exist, they are one less in order that the corresponding feedback gains internal to the particular subsystem. Dissert. Abstr.

N69-26704*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.

ESTIMATION OF THE PARAMETERS OF SAMPLED-DATA SYSTEMS BY STOCHASTIC APPROXIMATION

Caswell B. Neal Jan. 1969 223 p refs

(Grant NGR-05-018-022)

(NASA-CR-101167; USCEE-333) Avail: CFSTI

The problem of determining the sampling interval of either closed loop or open loop sampled-data control systems was investigated. Specifically, this dissertation is concerned with estimation of parameters in systems that have internal sampling, but have continuous input and output. Three methods were employed for the estimation of sampling intervals and other parameters of a sampled-data system. In all methods, the cost function was the integral of norm-squared error, where the error function was defined as the difference between the observed state vector of the system, and the state vector of the model. The first method employed programmed search to vary the model parameters in order to minimize the cost function. The second method employed iterative gradient search by means of discrete sensitivity difference equations for the various model parameters. The third, and most important, method used was that of stochastic approximation. This permitted observation noise. The mean-square convergence of the model parameters to the true parameters of the system was proved. Stochastic approximation was applied to the practically important problem of estimating the parameters of the human operator from records of scalar input and scalar output of the human operator operating in a closed loop configuration. Parameters were estimated successfully in both continuous and sampled-data models of human operators. Author

N69-26727 California Univ., Los Angeles.

COMPUTATION OF OPTIMAL CONTROL: SOLUTION OF THE MULTIPOINT BOUNDARY VALUE PROBLEM

James Lee Starr (Ph.D. Thesis) 1968 171 p

Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-16615

This dissertation concentrates on solution algorithms for the two-point boundary value problem which results as a necessary condition for optimality as obtained from Pontryagin's maximum principle or the calculus of variations approach. The development of the theory for treatment of in-flight state variable constraints is given. It is shown how the numerical techniques can be used to handle the resulting multipoint boundary value problem. The methods studied include function space steepest descent, conjugate gradient, classical steepest descent, parallel tangents, Fletcher and Powell (variable metric), Newton-Raphson, Fibonacci search, golden section search, pattern search, and iterated multiple substitution polynomials. The theoretical development and the complete computational algorithms of these techniques are given in sufficient detail to make this work self-contained. A discussion of the advantages and disadvantages of each method from a computational standpoint are also given. Numerical results from computer studies are presented to illustrate the principal characteristics of the methods. Nongradient numerical techniques are emphasized. Dissert. Abstr.

N69-26730 Rice Univ., Houston Tex.

A CHARACTERIZATION OF PARABOLIC LEBESGUE SPACES

Charles Howard Sampson (Ph.D. Thesis) 1968 91 p

Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-15656

The operator ∂^α is defined by a Fourier transform equation to be interpreted in the distribution sense. The parabolic Lebesgue space $\mathcal{L}^p_\alpha(E_{n+1})$ is defined to be $\partial^{-\alpha}(L^p(E_{n+1}))$. If $\alpha > 0$ a characterization of $\mathcal{L}^p_\alpha(E_{n+1})$ which is stated in terms of the functions themselves, rather than their Fourier transforms, is given. If periodic distributions are considered the operator j^α is defined in an analogous manner, with Fourier series replacing Fourier transform. $\mathcal{L}^p_\alpha(T_{n+1})$ is then defined to be $j^{-\alpha}(L^p(T_{n+1}))$, where T_{n+1} is the n+1-dimensional torus. The spaces $\mathcal{L}^p_\alpha(T_{n+1})$ are characterized, if $\alpha > 0$, with a characterization almost identical to the one given for $\mathcal{L}^p_\alpha(E_{n+1})$. Dissert. Abstr.

N69-26731 Cornell Univ., Ithaca, N.Y.

GENERIC EMBEDDINGS

Jacob Manuel Plotkin (Ph.D. Thesis) 1968 40 p

Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-15734

Since Cohen showed the independence of the axiom of choice from the other axioms of ZF, a number of people have used his forcing technique to show how badly choice can fail while certain vestiges of it remain. Many of these arguments involve the introduction of a generic sequence or generic set of generic sets of ordinals into a countable standard model of ZF+V=L. The desired results then follow by the use of clever permutation and forcing arguments. This subject is approached from a different angle. Generic copies of relational systems into $P^2(\omega)$ are introduced. The aim is to reduce the forcing arguments to a minimum and to deduce facts about the ensuing model of set theory from model theoretic properties of the relational system that is generically introduced. Dissert. Abstr.

N69-26732 Pittsburgh Univ., Pa.

NEW COEFFICIENTS FOR FIFTH AND SIXTH ORDER PREDICTOR-CORRECTOR ALGORITHMS

Kenneth Schoen (Ph.D. Thesis) 1968 62 p

Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-16636

The problem of determining the real coefficients for fifth and sixth-order predictor-corrector algorithms was investigated. Coefficients for fifth and sixth-order predictor-corrector algorithms with an increased range of absolute h stability have been determined. In addition, the new fifth-order predictor truncation error term is smaller in magnitude than either Krogh's or Adams's error term. Furthermore, these new algorithms were demonstrated to be just as accurate as the Adams or Krogh methods for some test equations of type (1). Finally, regions of absolute and relative stability in the complex h plane for these new coefficients definitely contain the regions of stability for both the Adams and Krogh procedures. Dissert. Abstr.

N69-26749# Environmental Science Services Administration, Boulder, Colo. Earth Sciences Labs.

TABLES OF INTEGRALS FOR THE SPHERICAL HARMONIC EXPANSION OF THE HYDROMAGNETIC EQUATIONS

Keith Leon McDonald and Charles O. Stearns Jan. 1969 74 p refs

(AD-683517; ERL-94-ESL-5) Avail: SOD $3.70 CFSTI CSCL 12/1

The method of spherical harmonic expansion of the hydromagnetic equations for incompressible media involves two well-known integral forms that are evaluated by standard numerical integration methods. The results are tabulated to 10 significant

figure accuracy for all sets of principal integers inclusive of an 8th-degree harmonic analysis. Extension to compressible media introduces two further surface integral forms that are each simply evaluated in terms of a finite sum of products of the above tabulated integrals. A general development is presented of the known interrelationships between these four basic integrals, and their selection rules are discussed. Their occurrence in the coupling elements is made explicit in the appendix. Author (TAB)

N69-26807# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
A NEW TECHNIQUE FOR DISCOVERING CAUSAL INFLUENCES EXERTED BY TWO VARIABLES ON EACH OTHER
H. I. Weisberg 17 Jan. 1969 21 p refs
(Contract N00014-67-A-0298)
(AD-683689; TR-24) Avail: CFSTI CSCL 12/1

A method is developed to study possible causal influences exerted by two variables on each other. The method makes use of an experimental scheme introduced by Lazarsfeld in which dichotomous measurements are made on each variable at two different points in time. Several types of influence are defined in such a way that they can be studied by looking at interactions in certain 2 x 2 contingency tables. Author (TAB)

N69-26809# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
THE BOLTZMANN COLLISION INTEGRALS. PART 2: RIGID SPHERES
Suresh Madhusudan Deshpande and Roddam Narasimha Jan. 1969 16 p refs
(ARC-TN-2-Pt-2) Avail: CFSTI

It is shown that the collision integrals for a rigid sphere gas can be expressed in closed form when the distribution is a sum of Maxwellians. Typical results are quoted, and they show the smoothing effect of the gain operator on the distribution function. Author

N69-26813# Princeton Univ., N.J. Econometric Research Program.
MAXIMIZATION BY IMPROVED QUADRATIC HILL-CLIMBING AND OTHER METHODS
Stephen M. Goldfeld, Richard E. Quandt and Hale F. Trotter Apr. 1968 22 p refs
(Grants NSF GS-1840; NSF GS-823)
(PB-180041; RM-95) Avail: CFSTI CSCL 05C

The frequent occurrence of many-dimensional maximization problems in the physical and social sciences has prompted the development of several efficient algorithms for numerical maximization of functions of several variables. Some of the most promising of these are the various types of conjugate gradient methods developed by Davidon, Powell, and others. The authors developed an algorithm, presented in a previous paper, which is based on maximizing at each iteration a quadratic approximation to the function on a sphere the radius of which is determined by the goodness of the previous approximation. The purpose of this paper is twofold. First the authors introduce a generalization of their algorithm, based on an observation contained in their previous paper. Secondly, they compare the improved algorithm with the earlier version as well as with the Davidon and the Powell algorithms. Author (USGRDR)

N69-26819 Southern Methodist Univ., Dallas, Tex.
SENSITIVITY ANALYSIS OF OPTIMUM SMOOTHING AND FILTERING ALGORITHMS
Robert Eugene Griffin (Ph.D. Thesis) 1968 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-17050

A sensitivity analysis of the covariances of estimate errors is conducted for optimal linear filtering and smoothing computational algorithms. The results of this analysis are algorithms which can be used to compute covariance matrices of the actual estimate error, large scale sensitivity functions of the covariance matrices, and small scale or differential sensitivity functions of the covariance matrices. These algorithms include procedures for the sensitivity analysis of the filtering, fixed-interval smoothing, and fixed-point smoothing methods for both continuous and discrete linear systems. These algorithms are in the form of matrix differential equations for continuous systems and matrix difference equations for discrete systems. Several examples are presented to illustrate the use of these algorithms. Dissert. Abstr.

N69-26846 Wisconsin Univ., Madison.
DEVELOPMENT OF MATHEMATICAL MODELS FOR DRILLING TEMPERATURE
Umesh Kumar Saxena (Ph.D. Thesis) 1968 231 p
Avail: Univ. Microfilms: HC $10.00/Microfilm $3.00 Order No. 68-13660

An analytical solution for temperature distributions in a drill, under various assumptions, was obtained. A new approach for evaluation of the amount of heat generated at the cutting edge was employed. This approach shows that the cutting edge temperature is significantly affected by the number of divisions into which the cutting edge is divided for the calculation of the amount of heat generated. A study of the influence of a pilot hole showed that the drill temperature near the chisel edge is considerably affected by the chisel edge heat source. Temperature distributions in a drill were also obtained using an approximate method which has a lesser number of assumptions than the analytical solution. The finite difference method is applied only to a simplified geometry and boundary conditions. The temperature variation in the vicinity of the chisel edge remains almost constant, agreeing with the tendencies shown by the experimental data. Dissert. Abstr.

N69-26860 Idaho Univ., Moscow.
CONTRACTIBLE OPEN MANIFOLDS N ≥ 5 AND CELLULAR MAPS
James L. Stern (Ph.D. Thesis) 1968 26 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17006

This paper presents the characterization of contractible open manifolds, $n \geq 5$, and an equivalence between pointlike maps and cellular maps. Theorem 1: Every contractible open manifold M^n $n \geq 5$, is the union of two open cells. Theorem 2: Let M be an open contractible manifold, $n \geq 5$. By Theorem 1, assume $M \subset O_1 \cup O_2$ where O_1 and O_2 are open cells. Assume for every compact set $F \subset M$ there exists an open cell O_3, a closed cell C and a compact set D such that $O_3 \subset C \subset O_1$, $F \subset D \subset (O_3 \cup O_2)$ and $O_3 \cup O_2$ is a 2-connected manifold and that $(O_3 \cup O_2)$ D is 1-connected. Then $M = E^n$. Theorem 3: Let M^n be an n-dimensional manifold without boundary (compact or not), $n \geq 5$. Let f be a pointlike compact map from M onto M, then f is a cellular map. Define a set A to be cellular if $A = \bigcap_i C_i$ where each C_i is an n-cell and $C_{i+1} \subset$ int. C_i. Define a map from M to M to be pointlike if $x \in M$ implies $f^{-1}(x)$ is cellular. Define a map to be cellular if $A \subset M$ and A is cellular implies $f^{-1}(A)$ is cellular. Dissert. Abstr.

N69-26874 California Univ., Los Angeles.
NORMS ON COMMUTATIVE BANACH ALGEBRAS
Thomas Anthony Slobko (Ph.D. Thesis) 1968 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16579

This is a study of the relationship between the group structure of a topological group and an arbitrary algebra norm on a function algebra on the group. The space, C(G) is considered of all continuous complex-valued functions on a compact (not necessarily Abelian) group, G. If S_a is the shift operator on C(G), that is, the operator defined by S_a (f)(x) = f(xa), and $\|\ \|$ is an arbitrary algebra norm on C(G), we show that if every S_a is continuous in the topology of $\|\ \|$, then the topology of $\|\ \|$ is the same as the topology of the supremum norm. This strengthens the result of K. de Leeuw that if $\|S_a(f)\| = \|f\|$ and in addition the map $a \to S(f)$ from G to C(G) is continuous for each f_0, then $\|\ \|$ is equivalent to the supremum norm. We also consider de Leeuw's second condition above, and show that if G is first countable, then it alone is sufficient to guarantee that the arbitrary algebra norm is equivalent to the supremum norm. Dissert. Abstr.

N69-26875 State Univ. of New York at Buffalo.
ON THE STRONG LAW OF LARGE NUMBERS
John Joseph Slivka (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-17329

Let $X_1, X_2, \ldots$ be a sequence of mutually independent and identically distributed random variables with common finite mean $\mu = E(X_1)$, and let $S_1, S_2, \ldots$ be the corresponding sequence of partial sums, that is, $S_n = X_1 + \ldots + X_n$ for all positive integers n. Let $Y_k = 1$ if $|k^{-1}S_k - \mu| \geq \lambda (> 0)$ and 0 otherwise, and define $N_m = \sum_{k=1}^{m} Y_k$ and $N = \sum_{k=1}^{\infty} Y_k$. The strong law of large numbers simply states that $P[N < \infty] = 1$. It is shown that as $m \to \infty$, the distribution function and probability density function of N_m tend to those of N uniformly with respect to the range variable of N, and that the existence of the moment generating function of X_1 is a sufficient condition for the existence of all moments of N and for the convergence of the moments of N_m to those of N. Bounds are derived for $P[N_m \leq j] - P[N \geq j]$, and $E(N) - E(N_m)$. Dissert. Abstr.

N69-26876 Kansas Univ., Lawrence.
GROUPS WITH CATEGORY
Thomas Stephen Shores (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17453

This paper considers several problems concerning groups with Σ category, which are defined as follows: Let Σ be a group theoretic class and define $C_1(\Sigma) = \Sigma$. Inductively, if $C_\alpha(\Sigma)$ is defined for all ordinals $\alpha < \beta$, let $C_\beta(\Sigma)$ be the class of those groups which can be expressed as the set theoretic union of normal subgroups, each of which belongs to some $C\alpha(\Sigma)$, $\alpha < \beta$. We then let $C(\Sigma)$ be the union of all the classes $C_\beta(\Sigma)$ and call a member of $C(\Sigma)$ a group with Σ category. The notion of groups with category was first studied by P. Kontorovich in 1951. Dissert. Abstr.

N69-26886 Cincinnati Univ., Ohio.
AN APPROXIMATE CLOSED FORM SOLUTION FOR OPTIMAL FOLLOWING SYSTEMS WITH AMPLITUDE CONSTRAINT
Paul Shang-Yu Wu (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-15213

A particular investigation is made for systems whose output can be represented by a Fourier series. These systems are characterized by (1) a single input and a single output, and (2) time-invariant parameters. The maximum principle of Pontryagin and the quadratic performance index without terminal cost are used in developing this method. The closed form optimal solution is found to be related to the state vector and the desired output by a constant Riccati transformation, which is the steady-state solution (R) of a Riccati-type non-linear matrix differential equation. It is proved that (1) the solution (R) is stable, and (2) the solution converges to this steady-state solution (R) rapidly. It is found that for low order systems, the steady-state solution (R) can be expressed in terms of the roots of the optimal trajectory equation. Dissert. Abstr.

N69-26890 Kansas Univ., Lawrence.
INTEGRAL DOMAINS WHICH ARE ALMOST KRULL
Elbert M. Pirtle, Jr. (Ph.D. Thesis) 1968 55 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17438

The concept of almost-Krull domain is defined and the general theory of these domains is studied. The family of essential valuations of an almost-Krull domain R to construct a semigroup A(R) of fractionary ideal classes are discussed. The relations of A(R) to the divisor group D(R) of fractionary ideal classes as constructed are studied. Necessary and sufficient conditions for A(R) to be isomorphic to D(R) are determined. A study of irredundant intersections of valuation rings and an example are presented. Dissert. Abstr.

N69-26966# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON DISTRIBUTION FUNCTION: MOMENT RELATIONSHIPS IN A STATIONARY POINT PROCESS
Malcolm R. Leadbetter and Robert J. Serfling (Fla. State Univ.) Feb. 1969 21 p refs *Its* Mimeo Ser. No. 611
(Contract Nonr-855-09)
(AD-683322) Avail: CFSTI CSCL 12/1

Let G sub *n* (t) denote the distribution function for the time to the n-th event in a stationary regular point process, and F sub n (t) the corresponding distribution function, conditional on an event having occurred at t = 0. (i.e., F sub n (t) represents the distribution of the time from an arbitrary event to the n-th subsequent event). Let N(o, t) denote the number of events in [o, t). Relationships between the distribution functions G sub n, F sub n, and the moments (unconditional and conditional) of N(o, t) are obtained. Specifically, series are given for G sub n (t) in terms of factorial moments of N(o, t), and for F sub n (t) in terms of such moments, conditional on the occurrence of an event at t = 0. In particular, a series given in [2] for F sub N (T) is obtained as a corollary. Author (TAB)

N69-26980# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
GENERALIZED LINEAR REGRESSION ANALYSIS
F. Delano Knight Feb. 1969 28 p
(Contract AT(07-2)-1)
(DP-1128) Avail: CFSTI

A generalized computer program was developed to fit selected functions to experimental data by the method of least squares. This program is characterized by a wide selection of functional forms for the independent and dependent variables, an extensive listing of descriptive statistics, and a simple input form that facilitates program use. Author

N69-27007# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTRIBUTION IN SPACES AMBIGUOUS TO ORDERED LINEAR SPACES
V. V. Sazanov 16 Feb. 1968 9 p refs Transl. into ENGLISH from Tr. Mat. Inst., Akad. Nauk SSR (Moscow), v. 71, 1964 p 102–103
(AD-683287; FTD-HT-23-1276-67) Avail: CFSTI CSCL 12/1

It was shown in a previous publication that for the characteristic functional of random measures in a compactum, the Buchner theorem and the continuity theorems are formulated just as simply as in the finite case. The author shows that this result is valid in a significantly more general case. TAB

N69-27077# McDonnell-Douglas Co., Huntington Beach, Calif. Astronautics Co.
SURFACE MATCHING
S. J. Clark Apr. 1969 25 p Presented at Statist. Program Evaluation Comm., Los Angeles, May 1969
(Douglas Paper-10233) Avail: Issuing Activity

A process is described, mathematical in nature, which operates on surfaces. The process, called surface matching, is a nonheuristic, computerized method of solving the following problem: Given a set of altitude measurements taken at various places in the x–y plane, in which the relative distances and directions from each other are known, but whose absolute positions on the x–y plane are unknown; and given a contour map for this region; determine the absolute location of the point where the final measurement was made and determine the probability that this measurement was made at any given point in the plane. A solution to the problem is found by shifting the contours associated with each altitude measurement by an amount determined from the distance and direction measurements, and then displaying these shifted contours for the final position which would be represented by the intersection of the shifted contours. Author

N69-27103# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
NUMERICAL MULTIPLE INTEGRATION USING AN N-DIMENSIONAL SIMPSON'S RULE
Horace Heck Jan. 1969 34 p refs
(Contract DAHC03-68-C-0002; Proj. THEMIS)
(AD-683509) Avail: CFSTI CSCL 12/1

Most multiple integrals of practical interest have no known analytic solution. This necessitated numerical evaluation procedures. The method developed in this paper is an extension of the well known Simpsons rule. The cases of constant and variable limits of integration are considered. Author (TAB)

N69-27104# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
DISTRIBUTION-FREE REQUIREMENTS VECTOR b, IN LINEAR PROGRAMMING
Robert N. Braswell and Frederick M. Allen [1969] 26 p refs
(Contract DAHC04-68 C-0002; Proj. THEMIS)
(AD-683508; TR-11) Avail: CFSTI CSCL 12/2

Given a linear programming problem subject to random variation in one or more components of the requirements vector, but the corresponding probability distributions are completely unknown, the problem can be solved deterministically using only crude estimates, then sensitivity analysis can be applied to determine the effect of random elements as they occur. Once the solution is implemented, however, there is usually an appreciable cost of modification. This paper establishes a criterion for actually changing a particular solution, based upon the notion of non-parametric tolerance limits. The results are extendable to both the cost vector and activity matrix. Author (TAB)

N69-27113# Institut Fiziki Vysokikh Energii, Serpukhov (USSR)
AN INVARIANT EXPANSION OF SOLUTIONS OF RELATIVISTIC EQUATIONS
A. K. Agamaliev, N. M. Atakishiev, and I. A. Verdiev 1968 17 p refs In RUSSIAN
(IFVE-STF-68-34-K) Avail: AEC Depository Libraries

Relativistic equations for the nonzero mass vector field are considered. The relativistic invariant expansion of solutions inside and outside of light cone is obtained. It is shown that the nonrelativistic limit of a complete set of functions defined on the hyperboloid is the complete set corresponding to the flat three-dimensional space. Author (NSA)

N69-27117# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
NONLINEAR REPRESENTATIONS OF THE LIE GROUPS
Kh. Khristov and D. Stoyanov 1968 20 p refs
(ITF-68-56) Avail: CFSTI

A brief review of the general theory of the realization of a given Lie group by its structure constants is given. The classification of nonlinear relativization of the SU(2) group is considered. It is shown that SU(2) possesses a finite number of irreducible representations and all the representations of dimensionality more than there are reducible. Author (NSA)

N69-27145# Kansas Univ., Lawrence. Dept. of Mathematics.
THEORY OF BESSEL POTENTIALS. PART 3: POTENTIALS ON REGULAR MANIFOLDS
R. D. Adams, N. Aronszajn, and M. S. Hanna Jul. 1968 74 p refs
(Contract Nonr-58313; Grant NSF-GP-3460)
(AD-683327; TR-17) Avail: CFSTI CSCL 12/1

The present part of the Theory of Bessel Potentials contains Chapter 4 dealing with potentials on regular Riemannian manifolds. Author (TAB)

N69-27202# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF THE METHOD OF DIFFERENTIAL DESCENTS FOR THE SOLUTION OF NONLINEAR SYSTEMS
S. I. Alber et al 16 Feb. 1968 30 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 7, no. 1, 1967 p 14–32
(AD-683182; FTD-HT-23-23-68) Avail: CFSTI CSCL 12/1

The authors prove local theorems concerning the stabilization of the trajectories of the differential descent towards the points of the minimum of the function and to the solutions of the nonlinear systems. Basic functional identities and inequalities are derived. The local theorems are then applied to an investigation of the stabilization of trajectories towards the solution in the case when the solution is a simple nondegenerate root. This is followed by a study of the behavior of the trajectories in the vicinity of a rigorously nondegenerate manifold of solutions. The theory of the differential descent is then developed for direct application in the complex form. The article completes with a study of the differential descent (as a whole), with the problem considered in general form on Riemann manifolds. The main result is that for almost all initial points, the trajectory of the differential descent stabilizes towards a solution of the nonlinear system or towards the point of minimum of the function. TAB

N69-27218# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
CURRENT AND FIELD COMMUTATORS, REFERENCE FRAME AND SUM RULES
V. de Alfaro and C. Rossetti 1968 48 p refs Sponsored jointly by Ist. Nazl. di Fis. Nucl., Sez. di Torino and Ukr. Akad. Nauk, Kiev
(ITF-68-53) Avail: CFSTI

A general survey is given over present day views on current algebra, discussing in particular the role of the pion as a quasi-Goldstone particle and the importance of the reference frame

in deriving sum rules. A new class of superconvergence-like sum rules is presented which derives from a set of assumptions about field commutators and from Lorentz transformation properties.
Author (NSA)

N69-27252# Kansas Univ., Lawrence. Dept. of Mathematics.
SOME RESULTS OF EXISTENCE AND UNIQUENESS FOR NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS AND REMARKS ON THE APPROXIMATION OF SOME NONLINEAR ELLIPTIC EQUATIONS.
R. Temam Oct. 1968 42 p refs
(Contract Nonr-58313)
(AD-683328; TR-18) Avail: CFSTI CSCL 12/1

Some known results of existence and uniqueness for nonlinear partial differential equations are presented. The following methods are presently used to prove existence or solutions of nonlinear equations: (1) method of approximate solutions, (2) fixed point methods, and (3) existence results related to control theory. The main emphasis is placed on the method of successive approximation with consideration given to elliptic equations, evolution equations of the 1st order (parabolic equations), and evolution equations of the 2nd order (hyperbolic equations). K.R.G.

N69-27253# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTED ARTICLES FROM REPORTS OF THE ACADEMY OF SCIENCES OF THE UKRAINIAN SSR. SERIES A: PHYSICAL, TECHNICAL AND MATHEMATICAL SCIENCES, VOLUME 29, NO. 10
P. F. Filchakov et al 19 Nov. 1968 23 p refs Transl. into ENGLISH from Dopo. Akad. Nauk Ukr. RSR, Ser. A (Kiev), v. 29, no. 10, 1967 p 883–890, 903–907
(AD-683946; FTD-HT-23-327-68) Avail: CFSTI CSCL 12/1

Contents: An effective method of determination of the eigenvalues for ordinary differential equations; On the mechanism of crater formation in massive targets under high-speed impact of hard particles. TAB

N69-27265# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CONSTRUCTION OF ALGORITHMS FOR THE APPROXIMATION OF CERTAIN OPTIMAL CONTROL PROBLEMS
S. Ulm 22 Oct. 1968 19 p refs Transl. Akad. Nauk EstSSR, Izv. Ser. Fiz.-Mat. i Tekhn. Nauk (Estonia), v. 15, no. 2, 1966 p 167–177
(AD-683538; FTD-HT-23-674-68) Avail: CFSTI CSCL 12/1

The solution to certain optimum control problems can be reduced to problems of finding the absolute minima of certain functionals in function spaces. For an approximate solution to the latter problems use can be made of algorithms developed for the solution of nonlinear equations. In previous works by other authors Newtons method and a particular variant of the method of gradients were generalized for the solution of optimum control problems. On the basis of methods of functional analysis the present article gives a more general scheme for the construction of methods of this type for the solution of certain optimum control problems. TAB

N69-27269# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEMS OF BOUNDARY LAYER EQUATIONS FOR AXIALLY SYMMETRIC FLOWS
O. A. Oleinik 8 Nov. 1968 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 178, no. 4, 1967 p 777–780
(AD-684017; FTD-HT-23-954-68) Avail: CFSTI CSCL 20/4

The report presents a system of boundary layer equations for axially stationary and nonstationary flow around bodies of rotation. The system of boundary layer equations for axially symmetric three-dimensional stationary flow of an incompressible fluid is given. Theorems are obtained on the uniqueness and stability of the solutions, and a study is made of the question of the behavior of the solutions under unlimited time extension. Author (TAB)

N69-27289# Sandia Corp., Albuquerque, N.Mex.
DATA ANALYSIS INVOLVING SOLUTION OF THE FREDHOLM INTEGRAL EQUATION OF THE FIRST KIND
Frank Biggs Feb. 1969 107 p refs Sponsored by AEC
(SC-RR-68-711) Avail: CFSTI

A technique is developed and illustrated that uses information; e.g., estimates of measurement errors, which is supplemental to the actual data to obtain an improved mathematical description of the physical situation. The improved description then leads to better data analysis techniques, to means of making feasibility studies on experimental designs, and to methods of optimizing experimental parameters. Author (NSA)

N69-27335# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Eletrotechnik.
ON THE EULER-MAUPERTUIS PRINCIPLE OF MINIMUM EFFECT AND ITS FORMULATION FOR POINT MECHANICS [UEBER DAS EULER-MAUPERTUISSCHE PRINZIP DER KLEINSTEN WIRKUNG UND SEINE FORMULIERUNG FUER DIE PUNKTMECHANIK]
Richard Troester 1968 52 p refs In GERMAN
Avail: CFSTI

This study concerns the divergences that exist regarding the application of the calculus of variations to the Euler-Maupertuis principle. A definitive review of the basic concepts and rules of the calculus of variations as used in classical mechanics is initially presented. An equation is derived for the variation of a time integral which includes time variation. A physical explanation is given for treating the dynamic variational problem of mechanics in the case of non-holonomic secondary conditions differently than the geometric variational problems based on the calculus of variations. Energy equations are formulated for several mass systems of point mechanics. Because of the fundamental significance of the energy equation in the Euler–Maupertuis principle, only the methods that make allowance for the kinematic constraints which are energetically clear are considered; in the case of holonomic-scleronomic secondary conditions, this is the method of generalized coordinates; and in all other cases, it is the Lagrange multiplicant method. The Euler–Maupertuis principle is also formulated for the motion of a single mass point in the relativistic case and thereby yields of necessity the initial conditions for the Hamiltonian principle.
Transl. by K.W.

N69-27413# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SCATTERING OF LONG OCEAN WAVES
H. S. Zwibel and A. G. Gibbs Jan. 1969 18 p refs
(Contract AT(45-1)-1830)
(BNWL-913) Avail: CFSTI

The differential equation describing the scattering of long ocean waves by a localized scatterer such as a seamount is transformed to an integral equation of the form arising in quantum mechanical scattering theory. The application of various approximation techniques developed in quantum mechanics is discussed and, as an example, an analytical expression is obtained for the first Born approximation to the wave scattered by a cylindrically symmetric seamount of arbitrary profile. The range of validity of this approximation is determined. Author (NSA)

N69-27482# Oak Ridge National Lab., Tenn.
DIRECT CRITICALITY SEARCH IN SOLUTION OF FINITE-DIFFERENCE EIGENVALUE PROBLEMS
David Ray Vondy (Ph.D. Thesis) Mar. 1969 184 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2381) Avail: CFSTI

The system of finite difference equations which couple the neutron flux values at discrete points in phase space was cast into the general eigenvalue problem for a steady state condition. The feasibility of direct iteration toward a specified steady state condition, direct search, was demonstrated by computer calculations. A study was made of the equations and iterative behavior of calculations for the directed neutron flux in one dimensional slab geometry with anisotropic scattering and multi-group treatment of the energy variable. Calculations were also performed using Carlson's equations. Several problems encountered in analysis of a variety of nuclear reactor cores were solved by application of the direct search techniques to the formulation associated with the diffusion approximation to neutron transport. Comparison of the iterative behaviors of direct search and usual eigenvalue solutions indicates that only little additional effort is usually required for the former.
Author (NSA)

N69-27592# Syracuse Univ., N.Y. Physics Dept.
ON THE CONSTRUCTION OF A VECTOR CURRENT WITH A TIME COMPONENT OBEYING THE ALGEBRA OF CURRENTS
Michael Fitelson and Rodney Johnson [1968] 18 p refs
Sponsored in part by NSF
Avail: Issuing Activity

The connection is studied between current algebra and rigorous quantum field theory by constructing, in a model field theory, an isovector vector current whose time components obey the algebra proposed by Gell-Mann. An appropriate model theory is obtained by generalizing the $\lambda\phi^4$ theory of Glimm and Jaffe to include isospin. The construction requires the formation of bounded functions of spatially smeared currents operating on Fock space. It is shown that such bounded functions can be formed by showing that the smeared currents are essentially self-adjoint on an appropriate domain.
Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-28152# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE DETERMINATION OF VERTICAL VELOCITIES IN THE LOWER LAYER OF THE ATMOSPHERE
L. V. Lisitskaya 14 Nov. 1968 10 p refs Transl. into ENGLISH from Tr. Ukr. Nauchn. Issled. Gidrometeorol. Inst. (Leningrad), no. 54 p 64-70
(AD-683951; FTD-HT-23-849-68) Avail: CFSTI CSCL 4/1

The Ukrainian Scientific Research Hydrometeorological Institute, in making experimental studies of the evolution of stratus clouds, found that it was necessary to determine the mean velocity of vertical motions by area. After reviewing all methods described in the literature, a method was adopted which divided the area into quadrangles, with wind-sounding stations situated at the corners. Despite the fact that the wind-sounding station network was not dense enough to exclude the possibility for local influences on wind profiles, vertical-motion velocities were determined without constructing wind fields in order to simplify the computations and to make it possible to compute omega at any level. The method was tested in the Kiev area, with calculations of omega made at the 300-, 500-, 1000, and 2000-m levels of the atmosphere, using a grid overlay to determine the projections of the velocities at each level onto the normal of the quadrangle side passing through each station.
Author (TAB)

N69-26166# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HORIZONTAL TEMPERATURE GRADIENTS IN THE LOWER STRATOSPHERE OVER THE NORTHERN HEMISPHERE
V. S. Komarov 15 Jul. 1968 31 p refs Transl. into ENGLISH from Tr. Nauchno.-Issled. Inst. Aeroklimatologii (Moscow), no. 28, 1964 p 43-61
(AD-683081; FTD-MT-24-166-68) Avail: CFSTI CSCL 4/2

The geographic distribution of horizontal temperature gradients in the lower stratosphere over the northern hemisphere throughout the year is examined. The contribution of the thermal wind to the zonal component of the wind in the regions of steepest temperature gradient is calculated from the available data. The horizontal gradients along the meridians are calculated from charts of average temperature at the 100 and 50 mb isobaric surfaces for every 5 degrees of latitude and 10 degrees of longitude. The magnitude of the gradient in the middle lattitudes is smaller than in winter. Again in summer between 50 and 40 degrees north latitude over Central Asia, there is a region of large horizontal temperature gradients. The thermal wind occurring in regions of high gradient is said to be the chief reason for the increase and decrease of the zonal wind throughout the year.
Author (TAB)

N69-26178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICS ON JET STREAM COMPLEXES OVER SOUTHERN USSR
K. Saidnazarova 2 Jul. 1968 10 p refs Transl. into ENGLISH from Nauchn. Tr. Tashkentsk. Gos. Univ. (USSR), no. 270, 1966 p 67-71
(AD-683082; FTD-HT-23-350-68) Avail: CFSTI CSCL 4/2

A statistical analysis was made of the jet-stream complexes (two or more jet streams existing simultaneously at different altitudes) observed at 35 aerological stations in Southern USSR in the 1961-1963 period. Only those jet streams whose speed equalled or exceeded 60 m/sec (216 km/hr), and periods when two wind peaks existed simultaneously at different levels, were taken into consideration. Instances of three or more simultaneously-existing peaks were handled separately. The Dzhordzhio jet-stream classification was adopted for the analysis, but with the exception of lower stratospheric streams, higher-level streams were omitted. In 1959 there were only 42 occurrences of jet-streams complexes and in 1960, only 34. However, the number jumped to 235 in 1961; this increase was attributed to improvements in the radar observation techniques used by 1961, and to the fact that high-speed jet-stream complexes actually were more frequent to that year. Monthly statistics are given for the three years. Number of periods in which dual jet streams were observed. It is concluded that jet-stream complexes occur frequently enough to be considered normal aeroclimatic phenomena.
Author (TAB)

N69-28190# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AEROSYNOPTIC CONDITIONS OF THE HEIGHT OF THE UPPER CLOUD BOUNDARY ALONG THE TASHKENT-MOSCOW AIR ROUTE

I. V. Bugayeva et al 12 Jul. 1968 31 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Sredneaz. Inst. Gidrometeorol. (Tashkent), v. 10, no. 25, 1963 p 88–115
(AD-683088; FTD-MT-24-161-68) Avail: CFSTI CSCL 4/2

The report concerns the results of an aerosynoptic analysis of a large number (1,550) of flight reports collected along the Tashkent-Moscow air route by crews of TU-104 and IL-18 aircraft with respect to the height of the upper cloud boundary (at levels 5 to 12 km, with most data broken down by 1-km levels). There is a discussion of the characteristic heights of the upper cloud boundary along fronts, in different forms of pressure field, and in relation to advection of different signs, the position of the tropopause and other factors. The data are broken down by warm and cold seasons of the year, since the upper cloud boundary differs sharply in the case of convective clouds. Author (TAB)

N69-26218# RAND Corp., Santa Monica, Calif.
AN ANNOTATED BIBLIOGRAPHY OF DYNAMIC CLOUD MODELING, SUPPLEMENT
F. W. Murray Nov. 1968 15 p
(Grant E-37-67(N))
(AD-683676; RM-5582/1-ESSA-Suppl) Avail: Issuing Activity CSCL 4/2

The report is a bibliography of material dealing with numerical cloud models, experiments, and methodology. It covers the period from March to November 1968 and contains twenty-four entries. Some Russian-language publications are included. Author (TAB)

N69-26282*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
FORMATION AND STRUCTURE OF EQUATORIAL ANTICYCLONES CAUSED BY LARGE SCALE CROSS EQUATORIAL FLOWS DETERMINED BY ATS-1 PHOTOGRAPHS
Tetsuya T. Fujita, Kazuo Watanabe (Meteorol. Res. Inst.), and Tatsuo Izawa (Meteorol. Res. Inst.) Jan. 1969 41 p refs Prepared in part by Meteorol. Res. Inst.
(Grants NGR-14-001-008; E-198-68(G); NSF GF-255; JSPS GEO-29)
(NASA-CR-101140; SMRP-RP-78) Avail: CFSTI CSCL 04B

As a result of photographic experiments, fields of cloud motion over the eastern equatorial Pacific were mapped in detail. It was found that a large-scale flow from the Southern Hemisphere recurves after crossing the equator to form an anticyclone centered around 10N. Dynamical characteristics of this type of anticyclone were investigated by estimating the vorticity dissipating force from computed values of divergence and vorticity of low-cloud velocities determined from successive ATS-I pictures. Based upon evidence found through case studies, a model of an equatorial anticyclone is proposed in this paper. Numerical computations of cross-equatorial trajectories were performed by using the divergence-vorticity relationships and the vorticity dissipating force, which were obtained through numerical analyses. Author

N69-26298# Joint Publications Research Service, Washington, D.C.
STUDIES OF OCEAN WAVE PARAMETERS AND TEMPERATURE FLUCTUATIONS
V. V. Navrotskiy et al 13 May 1969 31 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR Fiz. Atm. I Okeana (Moscow), v. 5, no. 1, Jan. 1969 p 94–110; 124–127
(JPRS-48032) Avail: CFSTI

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1. STATISTICAL ANALYSIS OF SPATIAL TEMPERATURE FLUCTUATIONS IN THE SURFACE LAYER OF THE OCEAN V. V. Navrotskiy p 1–21 refs (See N69-26299 14-20)

2. POSSIBILITIES OF DETERMINING THE THREE-DIMENSIONAL STRUCTURE OF A WAVE-COVERED SEA SURFACE BY RADAR B. D. Zamarayev et al p 22–29 refs (See N69-26300 14-20)

N69-26299# Joint Publications Research Service, Washington, D.C.
STATISTICAL ANALYSIS OF SPATIAL TEMPERATURE FLUCTUATION IN THE SURFACE LAYER OF THE OCEAN
V. V. Navrotskiy *In its* Studies of Ocean Wave Parameters and Temp. Fluctuations 13 May 1969 p 1–21 refs (See N69-26298 14-20)
Avail: CFSTI

Temperature observations are analyzed of two runs in the Atlantic Ocean made using strings of thermistors. Cross correlation analysis of temperature fluctuations at different horizons reveals a complex nature of processes in the surface layers of the sea. An attempt is made at a physical interpretation of the determined statistical characteristics. Author

N69-26300# Joint Publications Research Service, Washington, D.C.
POSSIBILITIES OF DETERMINING THE THREE-DIMENSIONAL STRUCTURE OF A WAVE-COVERED SEA SURFACE BY RADAR
B. D. Zamarayev et al *In its* Studies of Ocean Wave Parameters and Temp. Fluctuations 13 May 1969 p 22–29 refs (See N69-26298 14-20)
Avail: CFSTI

The possibility of determining the two dimensional spatial (along the wave lengths) spectrum of waves using a radar set is demonstrated. This is based on the fact that the radar echo from the surface is functionally related to the form and electrodynamic properties of this surface. It is then possible to obtain the two dimensional correlation function and the two dimensional spectrum of sea waves. By supplementing these measurements with a measurement of the frequency spectrum at a point all the characteristics of sea waves are determined. Author

N69-26305# RAND Corp., Santa Monica, Calif.
NUMERICAL MODELS OF A TROPICAL CUMULUS CLOUD WITH BILATERAL AND AXIAL SYMMETRY
F. W. Murray Nov. 1968 39 p refs
(Grant E-37-67(N))
(AD-683683; RM-5870-ESSA) Avail: Issuing Activity CSCL 4/2

Comparison of two versions of a numerical model for cumulus convection. One version is symmetrical about a vertical plane; the other, about a vertical axis. It is found that the axisymmetric model grows more vigorously than the other in both speed and strength of development, but more realistically represents the relations between downdraft and updraft. The model, at least with the eddy exchange coefficients used, was found to be deficient in necessary turbulent entrainment. Author (TAB)

N69-26384# RAND Corp., Santa Monica, Calif.
HUMIDITY AUGMENTATION AS THE INITIAL IMPULSE IN A NUMERICAL CLOUD MODEL
F. W. Murray Jan. 1969 37 p refs
(Contract N00014-67-C-0101)
(AD-683258; RM-5932-NRL) Avail: CFSTI CSCL 4/2

A perturbation of relative humidity is used as a trigger to start the convection process in a numerical model of a cumulus cloud. The effects of varying the width and depth of the perturbation are studied. It is found that the width of the simulated

cloud is dependent on the width of the impulse, whereas the ultimate depth and rate of growth are dependent mainly on the depth of the impulse. If a suitable impulse is used, a simulated cloud results that has many of the properties of real clouds observed in an atmosphere with the same basic sounding as the computation. Author (TAB)

N69-26420# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
DYNAMIC INSTABILITY OF EASTERLY DISTURBANCES
Ta-Ceng Yang Bedford, Mass. AFCRL Nov. 1968 26 p refs Transl. into ENGLISH from Ch'i Hsiang Hsueh Pao (Peking), v. 35, no. 2, May 1965 p 189–199
(Contract F19628-68-C-0251)
(AD-683859; EMM-68-179; AFCRL-68-0603; AFCRL-Trans-30) Avail: CFSTI CSCL 4/2

The dynamic instability of easterly disturbances is investigated in terms of the variation of the coriolis parameter with latitude and the characteristic features of the flow pattern in temperate and low latitudes by means of a two-layer model. The results show that this model rise to easterly disturbances of relatively short wavelength of about 2400 km. Author (TAB)

N69-26424# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, Sep. 1968
Sep. 1968 16 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Institute for Meteorology, Uccle (Belgium) in September 1968 are given. ESRO

N69-26431# RAND Corp., Santa Monica, Calif.
WEATHER MODIFICATION RESEARCH—A DESIRE AND AN APPROACH
S. M. Greenfield Feb. 1969 16 p refs
(AD-683250; P-4027) Avail: Issuing Activity CSCL 4/2

The paper describes the necessity of understanding the atmospheric environment in depth as a prime requisite for weather modification. The role of numerical models in weather modification research is discussed. TAB

N69-26482# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, Jan. 1969
Jan. 1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Institute for Meteorology, Uccle (Belgium) in January 1969 are given. ESRO

N69-26594# RAND Corp., Santa Monica, Calif.
ATMOSPHERIC TELECONNECTIONS FROM THE EQUATORIAL PACIFIC
J. Bjerknes Jul. 1968 39 p refs Prepared in cooperation with Calif. Univ.
(Grant NSF GP-3193)
(PB-180047; P-3882) Avail: CFSTI CSCL 04B

The high index response of the northeast Pacific westerlies to big positive anomalies of equatorial sea temperature, observed in the winter of 1957–58, was found to repeat during the major equatorial sea temperature maxima in the winters of 1963–64 and 1965–66. The 1963 positive temperature anomaly started early enough to exert the analogous effect on the atmosphere of the South Indian Ocean during its winter season. The maxima of the sea temperature in the eastern and central equatorial Pacific occur as a result of anomalous weakening of the tradewinds of the southern hemisphere with inherent weakening of the equatorial upwelling. These anomalies are shown to be closely tied to the southern oscillation of Sir Gilbert Walker. Author (USGRDR)

N69-26652# Army Biological Labs., Fort Detrick, Md.
ON THE EQUATIONS OF NUMERICAL PREDICTION IN RELATION TO THE NON-DIVERGENCE CONCEPT
V. V. Bykov Jul. 1968 9 p refs Transl. into ENGLISH from Russian article
(AD-683051; Trans-589) Avail: CFSTI CSCL 4/2

The report discusses the approximate solution of differential equations which arise in numerical weather forecasting. TAB

N69-26661# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A CLIMATOLOGY OF CENTRAL GREAT PLAINS MESOSCALE CONVECTIVE SYSTEMS
R. A. Dirks Mar. 1969 66 p refs
(Grant E-10-68(G)) Avail: Issuing Activity

Dynamic and thermodynamic factors associated with squall line development are reviewed along with proposed initiating mechanisms. Mesoscale convective systems (100 km scale) are studied over one summer season (May–August 1966) in the central Great Plains area. Based on satellite photographs, radar observations, and standard synoptic data, the spatial and temporal distributions of the formation of these systems are analyzed. The analyses show preferred regions of initial development several hundred kilometers leeward of the Colorado Rockies while in the immediate lee of the mountains convection is largely suppressed. The synoptic conditions associated with meso-system formation are investigated and mean cases are constructed. Convective instability and a tongue of warm, moist air at low levels (850 mb) along with evidence of a short wave feature at upper levels (700 and 500 mb) are common characteristics. Other conditions such as the presence of the low level jet, jet streams aloft, or surface fronts are found to be related to a particular type of synoptic situation. Author

N69-26668# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
RECENT METEOROLOGICAL ROCKET DATA AND AN INTERNATIONAL STANDARD ATMOSPHERE TO 80 KILOMETERS
Allen E. Cole Washington, D.C. Office of Aerospace Res. Jan. 1969 22 p refs *Its* Air Force Surv. in Geophys. No. 209
(AD-683357; AFCRL-69-0001) Avail: CFSTI CSCL 4/2

Recent temperature measurements between 30 and 80 km are compared with the temperature-height profile for the U.S. Standard Atmosphere, 1962. The mean annual midlatitude daytime temperature-height distribution derived from Meteorological Rocket Network (MRN) observations supports the assumption that the U.S. Standard Atmosphere temperature profile is representative of mean midlatitude daytime conditions between 30 and 53 km. Above 53 km the MRN temperatures are warmer than standard. Mean annual 50-km temperatures computed from grenade experiments at Ft. Churchill and Wallops Island are 5 degrees to 7 degrees C colder than those based on MRN thermistor measurements. Part of this difference is attributed to the diurnal variation in temperature near the stratopause. Temperature observations taken with the Soviet meteorological rocket at Heiss Island and Volgograd are compared

with the MRN data and the U.S. Standard Atmosphere temperature-height profile. To satisfy the requirements for an International Standard Atmosphere to 50 km, it is recommended that the ICAO 32-km Standard Atmosphere be extended by adopting the 32- to 50-km layer of the U.S. Standard Atmosphere, 1962.
Author (TAB)

N69-26702*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SUPPORT DATA FOR NASA CONVAIR 990 METEOROLOGICAL FLIGHT 3, 5 June–21 JUNE 1968
L. Griffee, H. Cole, and W. E. Marlatt Nov. 1968 127 p
(Contract NASr-147)
(NASA-CR-101172) Avail: CFSTI CSCL 04B

Convair 990 Meteorological Flight 3 consisted of ten flights, the first on June 5, and the last on June 21, 1968. Eight of these flights were flown from Moffett Field, California; the other two were flown from Tulsa, Oklahoma. The documentation consists of seven sections: a brief coverage of the flights, a summary of experiments, a summary of photographic coverage, a summary of housekeeping operations, time comparisons for Flight #1, time record of the aircraft environment, and maps of the flight track.
Author

N69-26938 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 92, NO. 4: RESULTS OF THE SYNOPTIC SERVICE DURING 1968. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb), BERLIN READINGS, AND BRIEF SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND XCII, HEFT 4: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1968. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb), BERLINER MESSWERTE UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]
Richard Scherhag et al Apr. 1968 208 p refs In GERMAN
Avail: CFSTI

Detailed results of daily ground level and radiosonde atmospheric measurements for April, 1968, are presented. Extreme and mean values of temperature, pressure precipitation, and radioactivity were extracted for all standard pressure surfaces and several height levels and are depicted in weather charts and maps of the Northern Hemisphere. Included is a statistical weather prediction study for the area around Berlin, Germany.
Transl. by G.G.

N69-26994# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PORTABLE EQUIPMENT FOR THE AUTOMATIC RECORDING OF TEMPERATURE DIFFERENCE AND AVERAGE WIND VELOCITY AT LEVELS FROM 0.5 TO 5.0m
I. D. Orobinskii et al 24 Oct. 1968 13 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (Leningrad), no. 3, 1967 p 128–134
(AD-683572; FTD-HT-23-423-68) Avail: CFSTI CSCL 4/2

Portable equipment for the automatic recording of atmospheric temperature gradient and wind velocity at different levels is described. The equipment consists of a portable collapsible mast, temperature sensors, wind velocity sensors, control panel (which is housed together with the power supply), an electronic recorder of measured parameters, a P-33 resistance box and a NO-62 bridge. The equipment also includes 300 meters of shielded conductor cable. The equipment makes it possible to measure temperature differences as assigned altitudes (with an accuracy of plus or minus 0.03C) in the atmospheric layer close to the ground. It can also measure the average air layer temperature between preassigned altitudes (with an accuracy of plus or minus 0.001C) and the average wind velocity at specified altitudes (from 1 to 2 m/sec).
Author (TAB)

N69-26997# Air Force Cambridge Research Labs., Bedford, Mass.
WINDS, TEMPERATURES, AND DENSITIES OVER THULE, GREENLAND AT 25 TO 65 KILOMETERS
Arthur J. Kantor Jan. 1969 17 p refs *Its* Environ. Res. Papers No. 297
(AD-683749; AFCRL-69-0025) Avail: CFSTI CSCL 4/2

Preliminary estimates of mean monthly and annual wind, temperature and density patterns at Thule AFB are provided for altitudes 25 to 65 km. Maximum mean monthly zonal winds occur during the solstice months. Values are 30 mps from the east in June and nearly 60 mps from the west in December. The meridional wind flow is generally weaker and not as definitive as the zonal patterns. The warmest mean monthly temperatures approach 290K in June and early July at the stratopause, slightly above 50 km. The coldest stratopause apparently occurs in November or possibly December, but its temperature, roughly 260K, and height are not so obvious. The maximum annual range of mean monthly temperatures at altitudes 25 to 65 km approaches 55K at 40 km. At 25 km rocketsonde temperatures are 3K warmer, on the average, than temperatures derived from concurrently launched radiosondes. The maximum difference ranged from +6 to -3K. Lowest densities near the stratopause occur in winter and highest densities occur in summer. Mean monthly departures from the U.S. Standard Atmosphere, 1962, approach +40% near 60 km in summer and decrease to 40% or 45% below Standard above 50 km in February. Densities above 50 km for December and January may be 10% or 15% lower than the February values.
Author (TAB)

N69-27039# RAND Corp., Santa Monica, Calif.
ICE EXTENT ON THE SOUTHERN OCEAN AND ITS RELATION TO WORLD CLIMATE
J. O. Fletcher Mar. 1969 118 p refs
(Contract NSF-C415)
(RM-5793-NSF) Avail: Issuing Activity

As part of a continuing study of the nature of global climatic variations, an attempt is made to quantitatively assess the annual and long-term variations occurring in the Antarctic heat-sink region, and to relate these variations to variations in global atmospheric circulation. Emphasis is placed on the role of variable ice extent on the Southern Ocean in regulating heat exchange between ocean and atmosphere, and thereby influencing the thermal forcing of atmospheric circulation. For the purpose of this analysis, it is assumed that the southern heat sink comprises three concentric thermal regions: the continent, the pack ice, and the open sea, each of which can be characterized by a single set of curves that describe the annual variation of each component of the atmospheric heat budget.
Author

N69-27131# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE TIME-INTERPOLATION OF METEOROLOGICAL ELEMENTS
R. L. Kagan et al 23 Aug. 1968 16 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 194, 1966 p 3–10
(AD-683214; FTD-HT-23-519-68) Avail: CFSTI CSCL 4/2

The problem of interpolating the average monthly values of meteorological elements is considered. The analysis is conducted for air temperature and atmospheric humidity but the method can be applied to other meteorological elements which have a pronounced diurnal variation. Only the methods of linear interpolation are considered. The root mean square error of linear interpolation to the middle point is evaluated by the Drozdov-Shepelevskiy equation.
Author (TAB)

N69-27172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERMONTHLY VARIABILITY OF AVERAGE PERENNIAL VALUES OF TEMPERATURE AND PRESSURE IN THE FREE ATMOSPHERE ABOVE CENTRAL ASIA AND KAZAKHSTAN
S. N. Ivanova 11 Jul. 1968 19 p refs Transl. into ENGLISH from Tr. Tashkent. Srednеaziatskii Nauchn.-Issled. Gidrometeorologicheskii Inst. (USSR), no. 23, 38, 1965 p 35–43
(AD-683167; FTD-MT-24-167-68) Avail: CFSTI CSCL 4/2

The work investigates seasonal changes in temperature and pressure in free atmosphere by analyzing graphs of intermonthly variability of these elements. The analysis is based on perennial average monthly temperatures and pressures calculated for 11 stations of Central Asia and Kazakhstan. Author (TAB)

N69-27173# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
FURTHER RESULTS ON THE VELOCITY STRUCTURE IN THE 30–60 km REGION DEDUCED FROM PAIRED ROBIN SOUNDINGS Final Scientific Report, 1 Jun. 1965–31 Aug. 1968
George J. Boer, Jr. and James R. Mahoney 30 Sep. 1968 55 p refs
(Contract AF 19(628)-5075)
(AD-683335; AFCRL-68-0559) Avail: CFSTI CSCL 16/1

A brief description of the apparatus and data gathering and reduction techniques used in a falling-sphere experiment performed at the White Sands Missile Range on March 6, 1965 is given. The effect of including acceleration terms in the calculated wind velocities is examined. The spectra of the soundings are obtained and the effects of radar operating characteristics and data smoothing procedures are discussed. Shears are calculated and normalized histograms are obtained for 5 km regions throughout the soundings. The decay of correlation measure between soundings is used to obtain estimates of the horizontal and time scales of the motions. The deduced scales of motion are compared, for consistency, with simple gravity wave theory and the results are discussed in terms of gravity wave and tidal motions. Author (TAB)

N69-27327# National Severe Storms Lab., Norman, Okla.
A RAINFALL RATE SENSOR
Brian E. Morgan Nov. 1968 16 p refs
(ERLTM-NSSL-42) Avail: CFSTI

An instrument designed to measure rainfall rate is described. Rain water passes from a collector into a reservoir formed between two concentric electrodes while it empties from the reservoir through a small nozzle at its base. The water depth in the reservoir is related to the inflow or rainfall rate and determines the capacitance between the electrodes. An oscillator having the electrodes as capacitance elements translates the depth changes into frequency variations. The equations relating rainfall rate to frequency are developed and their relevance to the design of the instrument for various specific applications is stressed. Results from laboratory tests as well as actual rainfall measurements are given. Author

N69-27338# National Severe Storms Lab., Norman, Okla.
DETECTION AND PRESENTATION OF SEVERE THUNDERSTORMS BY AIRBORNE AND GROUND-BASED RADARS: A COMPARATIVE STUDY
K. E. Wilk, J. K. Carter, and J. T. Dooley Feb. 1969 62 p refs
(ERLTM-NSSL-43) Avail: CFSTI

Reflectivity estimates based on the S-band WSR-57 radar are used to evaluate the effects on core measurements by intervening precipitation. Problems of beam aspect and flight altitude are discussed in relation to the storm reflectivity profiles encountered during the test flights. Comparative presentations are analyzed in detail and examples of contour mapping and lightning detection with the ARSR-1D radar are given. The data indicate that precipitation attenuation of C- and X-band signals should not prevent their use for storm avoidance. Attenuation at the K_a-band is excessive, and use of this band is not advisable at middle and low flight altitudes. With the relatively narrow beam available at K_a-band, and an optional RHI presentation, this system offers a significant improvement in presentation and lessens the ambiguities caused by antenna tilt and beam aspects. Author

N69-27356 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 90, NO. 6: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, JUNE 1968 [METEOROLOGISCHE ABHANDLUNGEN. BAND XC, HEFT 6: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1968, JUNI]
Richard Scherhag et al 1968 100 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

The detailed results of the radiosonde ascents performed by the aerological station of the Institut für Meteorologie und Geophysik der Freien Universität Berlin are presented. Using these data monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause and the freezing level. The data of the ozone-ascents were given in tabular and graphical form. Author

N69-27362# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
AN OPERATIONALLY ORIENTED SMALL-SCALE 500-MILLIBAR HEIGHT ANALYSIS PROGRAM
Harry R. Glahn and George W. Hollenbaugh Mar. 1969 21 p refs
(WBTM-TDL-19) Avail: CFSTI

A computer program which performs analyses of 500-mb heights over the relatively dense data region of the United States and Canada by the method of successive approximations is described. The program includes error-detecting routines and can be used in an operational environment. The detail specified by the radiosonde reports is retained with a gridlength of about 100 miles. A listing of the program is included. Author

N69-27384# Joint Publications Research Service, Washington, D.C.
HYDRODYNAMIC THEORY OF SHORT-RANGE WEATHER FORECASTING
A. S. Monin 20 Mar. 1969 57 p refs Transl. into ENGLISH from USP. Mat. Nauk (Moscow), v. 96, no. 2, 1968 p 372–387
(JPRS-47684) Avail: CFSTI

The magnitude of weather processes is investigated by applying the equations of hydromechanics to a number of quantitative characteristics of the atmosphere. The spectrum of the period of fluctuations in the time of the meteorological elements is described as being divided into ten different ranges. The use of the adiabatic

approximation is discussed with relation to its applicability to short-range weather forecasting; adiabatic invariants are considered. The possible types of atmospheric motions during the adiabatic processes are classified, and the adaptation of the meteorological fields is discussed. The hydrodynamics equations can be simplified in such a way that the first kind of motions (the synoptic processes) important for the weather are described, while filtering out the rapid waves or motions which are insignificant. In this relation, the utilization of the quasi-geostrophic approximation, the quasi-solenoidal approximation, and the primitive equations is evaluated. The description of the vertical structure of the synoptic processes in integrating the forecasting equations is discussed. Forecasting accuracy of the hydrodynamic theory is analyzed for the atmospheric pressure field, temperature, wind, cloud cover, precipitation and hurricanes. P.A.B.

N69-27385 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 90, NO. 7: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGY und GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, JULY 1968 [METEOROLOGISCHE ABHANDLUNGEN. BAND XC, HEFT 7: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1968, JULI]

Richard Scherhag et al 1968 109 p refs In GERMAN; ENGLISH summary

Avail: CFSTI

The detailed results of the radiosonde ascents performed by the aerological station of the Institut fur Meteorologie und Geophysik, Berlin are presented. Using these data monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause and the freezing level. The data of the ozone-ascents were given in tabular and graphical form. Author

N69-27386# Freien Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 84, NO. 1: WEATHER SATELLITE OBSERVANCES AND THEIR EVALUATION. THE EUROPEAN WEATHER PICTURE, 1967 [METEOROLOGISCHE ABHANDLUNGEN. BAND LXXXIV, HEFT 1: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1967. Teil I, 1. VIERTELJAHR] Quarterly Report

Ingrid Haupt et al 1968 239 p refs In GERMAN; ENGLISH summary

(QR-1) Avail: CFSTI

The American weather-satellite ESSA 4 is described; it is a satellite which was launched on January 26, 1967, because the forerunner ESSA 2 had some difficulties with its orbital elements. The so-called "venetian-blinding"-effects in the APT-pictures of ESSA 4 are shortly mentioned. Moreover, there is a survey of all the APT-stations of the world installed upto the beginning of 1967. The Soviet weather-satellite KOSMOS 144 forms the subject of chapter 5, and chapter 6 contains some remarks on the snow- and ice-situation in the European-Atlantic area with exception of the Arctic. Daily European weather maps contain a cloud-mosaic with a short description and a table with orbital data of the satellite and special data for the APT-pictures, respectively. Listed records of the orbital data of ESSA 4 and NIMBUS 2 for the period of January–March 1967 are included. Author

N69-27388 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 92, NO. 11: RESULTS OF THE SYNOPTIC SERVICE DURING 1968. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb), BERLIN READINGS, AND BRIEF SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND XCII, HEFT 11: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1968. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb), BERLINER MESSWERTE UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]

Richard Scherhag et al Nov. 1968 324 p refs In GERMAN

Avail: CFSTI

Daily radiosonde measurements performed by the synoptic services of the Institute for Meteorology and Geophysics, Berlin, during November 1968 are presented. Using these data monthly temperature, pressure, precipitation, geopotential, and radioactivity maps and charts for ground level, 500 mb, and 300 mb were constructed for the Northern Hemisphere, Europe-Atlantic Ocean area, as well as local Berlin values. Included are brief studies on local weather prediction, satellite cloud photography over the Pacific, and automatic registration of optical cloud measurements. Transl. by G.G.

N69-27389 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 92, NO. 12: RESULTS OF THE SYNOPTIC SERVICE DURING 1968. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb), BERLIN READINGS, AND BRIEF SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND XCII, HEFT 12: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1968. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb), BERLINER MESSWERTE UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]

Richard Scherhag et al Dec. 1968 310 p refs In GERMAN

Avail: CFSTI

Synoptic weather maps presented for the month of December, 1968, were issued from the Institute of Meteorology and Geophysics, Berlin. Daily maps and charts contain temperature, pressure, and geopotentials for ground, 500 mb, and 300 mb levels of the Northern Hemisphere, as well as local Berlin measurements. Attached are studies on weather prediction for Europe, diurnal changes in tropical upper atmospheric winds, cloud formation over the Sea of Japan, precipitation over hilly countryaides in Sweden, and on atmospheric purple light phenomena over Berlin. Transl. by G.G.

N69-27458 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 94, NO. 3: DAILY ALTITUDE MAPS OF THE 100 mb LEVEL AND THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1968 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND XCIV, HEFT 3: TAEGLICHE HOEHENKARTEN DER 100-MB-FLAECHE UND DER 50-MB-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1968. TEIL III, 3. VIERTELJAHR]

Barbara Krieger, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al 1968 117 p In GERMAN

(QR-3) Avail: CFSTI

Presented are median, standard deviation, and corrected weather maps of the Northern Hemisphere for summer, 1968. Temperature, pressure, and geopotential for the 50 mb and 100 mb levels during the months June through September are given in tabular and graphical forms. Transl. by G.G.

N69-27559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING THE CAUSES OF THE STABLE POSITION OF THE CENTER OVER ASIAN ANTICYCLONE MONGOLIA
Z. M. Makhover 26 Mar. 1968 16 p refs Transl. into ENGLISH from Tr. Nauch.-Issled. Inst. Aeroklimatologii (Moscow), no. 38, 1967 p 54–59
(AD-683189; FTD-MT-24-44-68) Avail: CFSTI CSCL 4/2

In this article there is analysed the influence of dynamic and thermal factors on the conditions of the formation of the Asian anticyclone. Author (TAB)

N69-27575# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 87, NO. 2: STUDIES OF THE STATISTICAL CORRELATION BETWEEN SUICIDES AND WEATHER IN WEST BERLIN DURING THE PERIOD 1956–1965 [METEOROLOGISCHE ABHANDLUNGEN. BAND LXXXVII, HEFT 2: UNTERSUCHUNGEN UEBER STATISTISCHE ZUSAMMENHAENGE ZWISCHEN SELBSTMORDEN UND WETTER IN WEST-BERLIN WAEREND DER JAHRE 1956–1965]
Peter Schramm 1968 64 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

The meteorological phenomena that were considered are fronts, air circulation, temperature fluctuations, cloud averages, and the general weather situation. In the suicide data, an ascending trend in the annual mean could be discerned as statistically significant. This trend can be reduced to the age structure of the population. Weekly variations, with the greatest number of suicides on Monday and the smallest number on Saturday, as well as a characteristical average monthly dispersion, with high rates in the beginning and low rates in the second part of the month, were also established. These statistical characteristics probably have sociological and psychological causes. The frequency distribution of daily suicides of males corresponds with the computed Poisson distribution. The frequency distribution of female suicides deviates from the Poisson distribution. This deviation was proven by a χ^2 test and found to be statistically significant. Some of the results appear to be statistically related to meteorological phenomena. For example, general weather situations classified as warm and days with positive temperature deviations show positive deviations of the suicide rate. Situations classified as cold and days with negative temperature deviations show negative deviations of their average suicide data. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-28196*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYSIS OF TERRAIN BIAS ERROR IN PLANETARY RADAR ALTIMETERS
Richard F. Harrington and William D. Stanley Washington May 1969 39 p refs
(NASA-TN-D-5220) Avail: CFSTI

Terrain bias error in a pulse modulated radar altimeter with an omnidirectional antenna and a leading-edge range tracker was analyzed for planetary applications. The backscatter function of Muhleman was used as the radar cross section model. An impulse response was first derived as a basis for determining arbitrary pulse returns by linear systems techniques. An ideal square pulse was assumed for the transmitted pulse, and a computer program was developed for generating pulse returns. An ideal bandwidth-limited receiver was then simulated on the computer and used to filter the pulse returns. The position of the received pulse leading edge was defined as the time of the 50 percent amplitude point of the pulse. In order to assess the measurable error resulting from the pulse returns, an ideal square pulse was used as an input to the receiver simulation program. The position of the leading edge of the ideal square pulse after filtering was compared with that calculated from the pulse return. Results indicated that terrain bias error varies only slightly with filter type and number of poles, is approximately constant for bandwidths greater than one-half the reciprocal of the pulsewidth, but increases significantly as the bandwidth is decreased, and is directly proportional to pulsewidth. Author

N69-26232*# Michigan Univ., Ann Arbor.
COMPUTER MECHANIZATION OF SIX-DEGREE OF FREEDOM FLIGHT EQUATIONS
L. E. Fogarty and R. M. Howe Washington NASA May 1969 27 p refs
(Contract NASr-54(06))
(NASA-CR-1344) Avail: CFSTI CSCL 17G

Solution of the six degree of freedom flight equations for aircraft and missiles continues to represent one of the most important application areas for analog, hybrid, and digital computer systems. Important computer requirements such as accuracy and speed are dependent very much on the choice of axis system for the translation equations of motion. In this connection it is well known that the flight-path axis system makes much lower accuracy and speed demands on the computer than does the body-axis system. Despite this a number of current computer mechanizations continue to use body axes for solving the translational equations of motion. Because of this, unnecessary demands of accuracy or frequency response are placed on the computer and many mechanizations which could be all analog or all digital have shifted to hybrid implementation. The advantages of flight path axes are pointed out and the overall equation requirements for solving the six-degree of freedom flight equations are summarized. Author

N69-27268*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPLORER 35 ATTITUDE CONTROL SYSTEM
J. V. Fedor, T. W. Flatley, M. F. Federline, and J. R. Metzger Washington Jun. 1969 28 p
(NASA-TN-D-5187) Avail: CFSTI CSCL 17G

This report deals with background history, system description, system operation, maneuvering concept and theory, gas bearing testing, and preliminary flight performance of the attitude control system used on the AIMP E spacecraft (Explorer 35), launched July 19, 1967. Author

N69-27353*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW. VOLUME 3. CONTROL SYSTEMS RESEARCH AT MSFC
25 Jul. 1968 75 p refs
(NASA-TM-X-53768; Rept-3) Avail: CFSTI CSCL 22C

An indication of what is meant by optimal control can be obtained by considering a flow chart for a control system design process which proceeds from vehicle and environmental descriptions and a set of control system objectives to the final control system design. This design process can take place by at least the two routes. Conventional design involves hypothesizing a control system design, analyzing the system to see if the objectives were met, and, if not, making an iteration in which another control system design is guessed and analyzed. When an optimal control design

procedure is followed, the control system objectives are formulated as a mathematical performance index which is to be minimized or maximized. This mathematical problem is solved analytically or computationally to find the unique control which provides the maximum or minimum. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-26231*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW METHOD FOR TREATMENT OF UNCERTAINTIES IN NUCLEAR REACTOR HEAT TRANSFER CALCULATIONS
Harry J. Reilly, John D. Hansell (Toledo Univ.), and George L. Heath (Toledo Univ.) Washington May 1969 18 p ref
(NASA-TM-X-1802) Avail: CFSTI CSCL 18I

A method for performing probability calculations for fuel clad surface temperatures of nuclear reactors is presented. The method properly treats factors which vary systematically over the whole core, factors which vary over a plate, and those that vary at a spot. One method of choosing spot size for plate-type reactors is shown and a more general method is discussed. The method is not restricted to normal distributions. The calculated value for probability of success, that is, surface temperature not exceeding coolant saturation temperature, is identified as strictly applicable only to the instant of reactor startup. Also the effect of continued operation is discussed. It is observed that the probability of success may be more nearly equal to values obtained by the deterministic method than to those obtained by the statistical method. Author

N69-26233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIENCES WITH BERRYLLIUM SWELLING AND REPLACEMENT IN THE PLUM BROOK REACTOR
William Fecych Washington May 1969 15 p refs Presented at Am. Nucl. Soc. Meeting, Washington, D.C., 11–16 Nov. 1968
(NASA-TM-X-1794) Avail: CFSTI CSCL 09I

A description is given of problems encountered from distortion and failure of major reactor core components in the high neutron fluence regions of the Plum Brook Reactor. Reactor material surveillance programs, the failure mode of the components, component replacement methods, associated health hazards, and the distortion of components against neutron fluence are described. Author

N69-26270*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NUCLEAR THERMIONIC SPACE POWER CONCEPT USING ROD CONTROL AND HEAT PIPES
John L. Anderson and Edward Lantz Washington May 1969 32 p refs
(NASA-TN-D-5280) Avail: CFSTI CSCL 18K

A space power system using a fast spectrum nuclear reactor, out-of-pile thermionic diodes, heat pipes, and a dual central absorber rod type of reactivity control has been studied. Emphasis is placed on the neutronic aspects and general feasibility of the concept. Comparison is made between uranium-233 and uranium-235 nitride and plutonium-239 nitride fuels. In this concept heat is transferred from the reactor core to the thermionic diodes by layers of radial heat pipes stacked alternately with slabs of fuel. For this out-of-pile concept, which would supply about 130 kilowatts electric, the reactor can be considerably smaller than the equivalent reactor with in-pile diodes. Author

N69-26409*# Westinghouse Electric Corp., Pittsburgh, Pa.
IRRADIATION OF REFRACTORY FUEL COMPOUNDS, UO_2 AND UC, AT HIGH SPECIFIC POWER TO HIGH BURNUPS Final Report
M. G. Balfour [1968] 25 p refs
(Contract NAS3-3392)
(NASA-CR-72515; WCAP-7327) Avail: CFSTI CSCL 18J

Thirteen fuel capsules, containing UO_2 and UC fuel pins, were designed for irradiation at power levels from 20 to 50 kw/ft, and to achieve burnups between 10,000 and 80,000 MWD/MTU. Four of the capsules were irradiated at approximately 30 kw/ft to burnups of approximately 10,000 and 60,000 MWD/MTU. The high incidence of UO_2 pin failure (7 out of 12) in these capsules resulted in re-evaluation and termination of the program. None of the UC fuel pins in these capsules failed. Four other capsules received partial irradiation, but were not examined. Author

N69-26627# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ANALYSIS OF COOLANT MIXING IN THE FFTF FUEL BUNDLE
Andrew Padilla, Jr. 14 Mar. 1968 32 p refs Presented at 10th Natl. Heat Transfer Conf., Philadelphia.
(Contract AT(45-1)-1830)
(BNWL-SA-1688; CONF-680832-3) Avail: CFSTI

Coolant mixing studies in the fuel bundle which were carried out during the conceptual stage in the design of the FTR are presented. The purpose of these studies was to: (1) determine the temperature and flow distribution in the fuel bundle, (2) provide a technical basis for instrumentation of the driver subassembly, and (3) identify thermal-hydraulic problem areas in the design of the driver subassembly. Author (NSA)

N69-26648# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
CALCULATION OF FAST NEUTRON FLUX IN REACTOR PRESSURE TUBES AND EXPERIMENTAL FACILITIES
P. C. Barnett Jul. 1968 30 p refs
(AECL-3167) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.00

The computer program EPITHET was used to calculate the fast neutron flux (>1 MeV) in several reactor pressure tubes and experimental facilities in order to compare the fast neutron flux in the different cases and to provide a self-consistent set of flux values which may be used to relate creep strain to fast neutron flux. 15 references. Author (NSA)

N69-27012# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik.
THEORETICAL STUDY OF HYPOTHETICAL SERIOUS ACCIDENTS IN FAST POWER REACTORS
D. Brasse et al [1969] 18 p refs Transl. into ENGLISH from German Rept. KFK-813 Sponsored By US-Euratom Fast Reactor Exchange Program
(EURFNR-579; KFK-813) Avail: CFSTI

In the design of fast power reactors, the safety considerations are governed by the investigation of second excursions. These

excursions might occur when there is an assumed failure of the cooling system and, at the same time, a breakdown of all safety devices. Second excursions are mostly studied with the Bethe-Tait method. This method is developed further, and the effect of Doppler feedback and of delayed neutrons is studied. Author (NSA)

N69-27017# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
NRL REACTOR OPERATIONS REPORT, 1 JANUARY–30 JUNE 1968
Elbert H. Bebbs and Charles V. Strain Dec. 1968 31 p
(NRL-MR-1955) Avail: CFSTI CSCL 18/9

A summary is given of most aspects of reactor operations: operational data, pertinent information regarding maintenance and modifications to the facility, and services rendered during the period 1 January - 30 June 1968. The level of utilization of the reactor by in-house and outside users is discussed. Programs for which the reactor was used during the reporting period are also briefly described. Author (TAB)

N69-27096# Commissariat à l'Energie Atomique, Paris (France).
TECHNICAL ASPECTS AND ECONOMIC INCIDENTS OF TRANSPORTATION IN THE FUEL CYCLE [ASPECTS TECHNIQUES ET INCIDENCES ECONOMIQUES DES TRANSPORTS DANS LE CYCLE DES COMBUSTIBLES]
Y. Sousselier and M. Labrousse [1968] 21 p refs In FRENCH
Presented at the Symp. on Econ. on Nucl. Fuels, Gottwaldov, Czech., 27 May 1968
(CEA-CONF-1093; CONF-680541-1) Avail: AEC Depository Libraries

The power reactor fuel cycle is discussed from the French point of view. Areas of U loss during processing and reprocessing are listed. Safety and economic aspects are discussed. Methods of fuel and spent fuel transportation used for semidefinite Chinon reactors and Bugey Power Reactor are described; the advantages of using Pb shielded casks are considered. Costs of transporting spent natural U fuel are detailed; cost breakdowns are given for France. Transportation costs for $UO_2(NO_3)_2$, Pu, and enriched U are considered briefly. Total fuel cycle costs for a gas-cooled graphite reactor are considered. NSA

N69-27110# Los Alamos Scientific Lab., N. Mex.
HETEROGENEITY EFFECTS IN A RADIALLY LOADED REACTOR
R. J. La Bauve 27 Jan. 1969 9 p refs
(Contract W-7405-eng-36)
(LA-4024-MS) Avail: CFSTI

Calculations for one-, two-, and simulated three-dimensional cell models of a radially loaded reactor are compared. The final results from the more detailed cell calculations differ only slightly from the results of the simpler calculations. Author (NSA)

N69-27210# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
AN EVALUATION OF THE REQUIREMENT FOR INSTRUMENTING ALL FUEL CHANNELS IN THE FFTF
[1968] 10 p refs Sponsored by AEC
(BNWL-CC-1012) Avail: CFSTI

The considerations of the various purposes for instrumenting test and driver fuel elements in the FFTF are presented. The minimum requirements for this instrumentation are described. NSA

N69-27218# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
SPERT PROJECT Quarterly Technical Report, Jan.–Mar. 1968
T. G. Taxelius, ed. Nov. 1968 94 p refs
(Contract AT(10-1)-205)
(IDO-17287) Avail: CFSTI

Prompt moderator heating feedback was calculated in SPERT 3 E-core. Inspections and failure tests were made of SPERT 4 CDC Type 304 stainless steel clad urania F-type reactor fuel elements. Reactor safety experiments were performed on fuel elements and cores. NSA

N69-27217# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
SPERT PROJECT Quarterly Technical Report, Jul.–Sep. 1968
T. G. Taxelius, ed. Feb. 1969 19 p refs
(Contract AT(10-1)-205)
(IDO-17294) Avail: CFSTI

Studies on reactor fuel elements and reactor safety included: design characteristics of SPERT 4 CDC Zircaloy 2 clad urania pellet type rods and failure analysis of the same. NSA

N69-27233# AEG-Kernenergieanlagen, Frankfurt Am Main (West Germany).
STUDIES ON CYCLONES FOR STEAM SEPARATION IN BOILING-WATER REACTORS Annual Report, 1967
10 May 1968 68 p refs Transl. into ENGLISH from German *Its* Spec. Rept. no. 2
(Contract EURATOM-083-66-1-TEED)
(EURAEC-2048; EUR-3992) Avail: CFSTI

The development of a steam separator consisting of downflow cyclones for use in large reactors of the direct-cycle boiling-water type is described on the basis of a 600 MW(e) BWR. The experimental investigations with air–water mixtures into the problem of mixture distribution to cyclones in different positions in relation to the core are presented. The most suitable solution is a guide sheet arrangement, whereby each of the three concentric sets of cyclones has its own inlet channel. Each of these three concentric guide channels begins about 2 m above the core and deflects the mixture to the cyclones in the downcomer space. The mixture distribution to the cyclones in the two inside sets was studied experimentally on a full-scale model, the flows of two parallel cyclones connected to a mixture plenum being determined. The comprehensive measurements also include simulation of the flow distribution at the core outlet. The use of data to derive optimized geometrical parameters for cyclones is described. Author (NSA)

N69-27234# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FAST FLUX TEST FACILITY Quarterly Technical Report, Apr.–Jun. 1967
E. R. Astley Jan. 1969 153 p refs
(Contract AT(45-1)-1830)
(BNWL-541) Avail: CFSTI

Efforts were directed toward the achievement of a more comprehensive conceptual design of the split core concept. Seven conceptual variations of the reactor were devised. Conceptual designs were developed for structures and containment, heat removal, fuel handling, irradiation testing, and fuel examination. Studies and development supporting the conceptual design were made in core and systems analysis, in safeguards, physics, fuels, corrosion, chemistry, and metallurgy. Author (NSA)

N69-27235# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
FUEL ROD DEFORMATION IN THE SPERT 3 OXIDE E-CORE
W. H. Etz Jan. 1969 55 p refs
(Contract AT(10-1)-205)
(IDO-17291) Avail: CFSTI

Fuel rod deformation in the form of ridging of the cladding and rod bowing was detected in the SPERT III E-core following kinetics testing initiated from an elevated initial system temperature (500°F). The tests and analyses that were conducted to determine the cause of the deformation and the possible effects on proposed future tests of the reactor core are described. The deformation was concluded to be a phenomenon that may be expected under the SPERT III operating conditions. The deformation is not expected to have significant effects on the kinetic behavior of the SPERT III E-core. 17 references. Author (NSA)

N69-27254# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).

IRRADIATION OF MIXED UO SUB 2 –Pu O SUB 2 FUELS IN THE BR-3/PWR REACTOR

A. Lhost and H. Bairiot Jun. 1968 90 p refs Sponsored by US-Euratom Joint Res. and Develop. Program Its Spec. Rept. No. 10

(EURAEC-2072; EUR-4004) Avail: CFSTI

Plutonium-enriched natural uranium oxide fuel rods were fabricated for insertion in the BR-3 reactor to evaluate the behavior of mixed oxide ceramic fuels in power reactors and define the various characteristics of lattices optimized for plutonium. The UO_2-PuO_2 irradiation in the BR-3/PWR constitutes the first step in the statistical study of rod behavior under normal conditions of use in power reactors. This run is closely linked with the one carried out in the BR-3/VN, with a complete core subassembly enriched with plutonium, and with the one carried out in the BR-3 third core in which a large part of the core consisted of plutonium-containing subassemblies. Irradiation in the BR-3/PWR was the basis of investigation of fabrication method effects. The method consisted of adding plutonium as a fine grain fraction of the powder. Codes were used to estimate parameters of this important stage in the application of plutonium-containing fuels. Author (NSA)

N69-27274# Israel Program for Scientific Translations, Ltd., Jerusalem.

DISPERSION-FUEL NUCLEAR REACTOR ELEMENTS

A. G. Samoilov, A. I. Kashtanov, and V. S. Volkov 1968 230 p refs Transl. into ENGLISH of the book "Dispersionnye Teplovydelyayushchie Elementy Yadernykh Reaktorov" Moscow, Atomizdat, 1965 Published for AEC and NSF

(TT-68-50327; AEC-tr-6878) Avail: CFSTI

An extensive review is presented on dispersion fuel elements consisting of particles of fissionable material, dispersed in a continuous matrix of metal, alloy, ceramic material, etc. The chapters include: uses and design; main requirements for materials for these fuel elements; fabrication; mechanical and physical properties of dispersion type compositions; and irradiation stability of the elements. B. P.

N69-27288# Oak Ridge National Lab., Tenn.

CONCEPTUAL ECONOMIC ANALYSIS OF FLAME REACTOR CONVERSION OF UF_6 TO UO_2

R. B. Pratt Feb. 1969 28 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-2409) Avail: CFSTI

The design for the industrial-scale process was made from laboratory-scale information currently available. It became obvious early in the analysis that coversions requiring excess fluorine was too costly. Subsequent experiments in which a satisfactory product was made without excess fluorine are the basis of this estimate. Capital, operating, and consumable costs are estimated for plants ranging from 100 to 3000 kG U/day. The resulting costs for flame reactor conversions range from 22.00 to 6.80 $/kG U. These costs are compared with costs for the ammonium-diurante (ADU) and sol-gel processes. Author (NSA)

N69-27292# Kernforschungszentrum, Karlsruhe (West Germany). Institute fuer Reaktorbauelemente.

SENSITIVE DIRECT DETERMINATION OF OXYGEN IN GASES AND LIQUID METALS FOR TECHNICAL APPLICATIONS

H. Sundermann et al Sep. 1968 39 p refs Transl. into ENGLISH from German Rept. KFK-819 Sponsored by US-Euratom Fast Reactor Exchange Program

(EURFNR-567; KFK-819) Avail: CFSTI

A direct electric measuring method was developed for determination of oxygen in gases and liquid metals. A measuring probe for laboratory use was designed. The reliability of the method was tested in various media for possible use in reactor circuits. NSA

N69-27297# Kernforschungsanlage, Juelich (West Germany).

EXPERIENCES IN RADIATION PROTECTION DURING STRUCTURAL MODIFICATION OF THE EXPERIMENTAL REACTOR FRJ-1 (MERLIN) [STRAHLENSCHUTZERFAHRUNGEN BEIM UMBAU DES FORSCHUNGSREAKTORS FRJ-1 (MERLIN)]

H. Jahn and K. J. Laumen Nov. 1968 35 p refs In GERMAN

(JUL-555-RE) Avail: CFSTI

The reactor had been in operation for several years prior to shutdown, and the structural parts, especially in the tank's interior, were highly radioactive. Dosimetry, contamination studies, and measurements of atmospheric radioactivity conducted before, during, and after the structural modifications are described. The extensive measures taken to insure safety of the personnel working inside the tank and outside of the reactor are discussed. Transl. by K.W.

N69-27298# Atomic Energy Commission, Washington, D.C. Reactor Physics Branch.

PROGRESS IN REACTOR PHYSICS

Virgil W. Lowery, ed. and George P. Sakalosky, ed. Jan. 1969 162 p

(WASH-1125) Avail: CFSTI

Research in neutron thermalization, cross section measurements, basic shielding studies, experimental research on critical assemblies, nuclear data evaluation, reactor calculational methods development, fuel burnup studies, and neutron flux distribution investigations which are supported by the Division of Reactor Development and Technology are summarized. A general description of the scope of each individual task, of the recent work performed, and of work anticipated in the near future is presented. NSA

N69-27343# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FAST FLUX TEST FACILITY Quarterly Technical Report, Jul.–Sep. 1968

Dec. 1968 133 p refs

(Contract AT(45-1-1830)

(BNWL-917) Avail: CFSTI

Calculations were made for NPTR angular conical core concept. Fuel handling, radiation dose levels from accident analysis and fault tree were outlined for the fast flux test facility. Loop pipes and systems were designed, developed, and tested for reliability of gamma intensity and development of closed sodium. Design and development of instruments, core concepts and systems for the fast test reactor are presented. The effects of temperature, environment, rupture, and irradiation of type 304 stainless steel are discussed. Reactor fuels and reactor safety were discussed. NSA

N69-27344# Battelle-Northwest, Richland, Wash.
REACTION OF GASEOUS IMPURITIES IN A HIGH TEMPERATURE GAS-COOLED REACTOR
R. C. Giberson and G. L. Tingey 16 Dec. 1968 29 p refs
Contract AT(45-1)-1830)
(BNWL-974) Avail: CFSTI

The Graphite Oxidation Program (GOP) computer code was updated to study the gas–graphite reactions in an HTGR. The effect of radiolytic as well as thermal reactions on the steady-state gas compositions of an operating HTGR is determined. The code is also useful in calculating the possible consequences of various reactor accidents. Water injection tests at the Dragon reactor were analyzed with the code. Author (NSA)

N69-27348# Kernforschungsanlage, Juelich (West Germany). Institut Fuer Reaktorwerkstoffe.
TECHNOLOGICAL PROPERTIES OF BERYLLIUM OXIDE MODERATOR ELEMENTS FOR A HIGH-TEMPERATURE THERMAL BREEDER REACTOR OF THE SPHERICAL-PILE TYPE [UEBER DIE TECHNOLOGISCHEN EIGENSCHAFTEN VON BERYLLIUMOXID-MODERATORELEMENTEN FUER EINEN THERMISCHEN HECHTEMPERATUR-BRUTREAKTOR VOM KUGELHAUFENTYP]
F. E. Buresch Sep. 1968 84 p refs In GERMAN
(JUL-552-RW) Avail: CFSTI

Nuclear reactions in beryllium oxide moderator elements release highly absorbant lithium isotopes and increase the volume of the beryllium spheres so that mechanical strength of the moderator decreases. It is proposed to reverse the radiation damage in breeder reactor beryllium oxide moderators by heat treatment so that developed fission products evaporate and volume expansion is reversed. Also recommended are additions of zirconium oxide, graphite, and metals with high melting points to the pure beryllium powder so that the pellet sintering process produces dense grains of ca. 3/um diameter. These sintering additions provide increased creep resistance and dispersion strength and increase bending resistance at high temperatures to more than 20 kg/mm^2. G.G.

N69-27354 Hahn-Meitner-Institut fur Kernforschung, Berlin, (West Germany). Sektor Kernchemie.
NUCLEAR CHEMISTRY COMPENDIUM. PART 2: INSTRUMENTS FOR MEASURING NUCLEAR RADIATION [KERNCHEMISCHES KOMPENDIUM. TEIL 2: KERNSTRAHLUNGS-MESSGERAETE]
K. E. Zimen, H. W. Levi, P. Moeller, T. Friese, and H. Klessmann Jan. 1969 97 p refs In GERMAN
(HMI-B-79-Pt-2; B-C-44) Copyright. Avail: Issuing Activity

This detailed review of radiation measuring instruments is intended for advanced students as well as practicing chemists, physicists, pharmacists, biologists, and physicians. A description of typical radiation measuring instruments is presented which covers: (1) radiation detectors and related aspects of gas ionization, ionization chambers, proportional counters, Geiger counters, scintillation counters, and semiconductor detectors; (2) electronic modules of such instruments, including high-voltage sources, amplifiers and preamplifiers, discriminators, coincidence and anticoincidence circuits, ratemeters, and digital counters; and (3) impulse height analyzers, including single and multiple channel analyzers. The general electronic characteristics of the instruments are explained. Tables, graphs, and a bibliography are included. Transl. by K.W.

N69-27360# Commissariat a l'Energie Atomique, Grenoble (France).
MEASURE OF POWER OF FISSILE SAMPLES: CYRANO DEVELOPMENT [MEASURE DE PUISSANCE SUR ECHANTILLONS FISSILES DEVELOPPEMENT DES CYRANO]
J. Berger and J. Perrin 18 Jul. 1968 20 p refs In FRENCH Presented at Colloq. EURATOM sur les Depositifs d'Irradiation, 10-11 Oct. 1968
(CEA-CONF-1121; Pi(NT)-170-108) Avail: CFSTI

A device developed for the irradiation of fuel samples at high linear power. It is equipped with an apparatus for nuclear power measurement and with neutron and γ flux measurements. The device is constructed of a standard furnace equipped with a calorimetric system, a sample gate, the associated fuel and measurement apparatus, and structural elements. Particular modifications of the device (Cyrano, Circe, Polycarpe, and Nadia) and the results obtained by them are described. The Cyrano installation is particularly well adapted to this type of irradiation. NSA

N69-27369# Oak Ridge National Lab., Tenn.
FISSION PRODUCT RELEASE FROM AN OVERHEATED HTGR FUEL (ORR POOLSIDE CAPSULE 06-11)
S. H. Freid, H. J. de Nordwall, D. R. Cueno, J. A. Conlin, C. L. Segaser et al Feb 1969 39 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2388) Avail: CFSTI

The ORR poolside capsule experiment was designed to measure and characterize the release of mobile fission products from HTGR fuel during a simulated accident that would result in a temperature rise of the fuel at power. A standard fuel, in the form of UC_2 particles in a bonded matrix was used for this and other Nuclear Safety Program studies to facilitate comparison of results. The capsule, 06-11, operated with a fuel-graphite interface temperature of 1050°C and a corresponding central fuel temperature of 1220°C for 23 hours, then the temperatures were raised to the planned accident simulation; 1450°C in the graphite fuel interface, 1720°C central fuel temperature, by advancing the capsule further toward the reactor. These conditions were held for 9 hours until the reactor shutdown. The bonded fuel showed no sign of damage. Fission product analysis of the fuel capsule components and fission product traps showed that, with the exception of iodine and ruthenium, essentially all of the nongaseous fission products were retained in the fuel. Author (NSA)

N69-27398# Tracerlab., Inc., Richmond, Calif.
REPORT OF STUDIES WITH PARTICLES IMPACTED ON COPPER PLATES FROM THE ABLATION OF Pu-238 O SUB 2 FUEL PARTICLES UNDER CONDITIONS SIMULATING ATMOSPHERIC RE-ENTRY
W. D. Holland Jan. 1969 210 p refs Prepared for Sandia Labs.
(SC-CR-68-3470) Avail: CFSTI

With six samples composed of particles that contained ^{238}Pu, particle studies were performed by autoradiography and electronic alpha counting. The particles, which were collected on polyvinylchloride coated copper plates, were collected during the ablation of individual SNAP fuel particles in a 40 kW hyperthermal arc tunnel under conditions simulating atmospheric re-entry. Three re-entry conditions were simulated. Size distribution histograms of equivalent $^{238}PuO_2$ particle diameters greater than 0.2 μ were obtained for each sample. These equivalent $^{238}PuO_2$ particle diameters range from 0.2 to 13.5μ. Typical radioactive particles were taken from each sample. Results of radiochemical analysis of all particles collected on five of the impactors and of individual particle measurements obtained by the hollow-star and electronic-counting techniques were used to tabulate the mass distributions from zero to the size of the largest particle found. Author (NSA)

N69-27406# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ENGINEERING OF LARGE SPARK CHAMBERS AND POWER PULSE SUPPLYING GENERATORS
K. A. Baicher, Yu. N. Zykin, V. I. Nikanorov, I. Kh. Nozdrin, A. F. Pisarev et al. 1968 16 p ref In RUSSIAN
(JINR-P13-4191) Avail: AEC Depository Libraries

The technology of construction one-gap spark chambers 150 × 150 × 2 cm in size is described. The chamber electrodes are made of thin foil. The devices for foil stringing and glass cutting, the table for stringing up the chambers as well as the vacuum system for filling and evacuation of large chambers are described. A high-voltage power generator for supplying large chambers is also described. Author (NSA)

N69-27424# Oak Ridge National Lab., Tenn.
USE OF CARBON DIOXIDE TURBINES FOR ADVANCED REACTORS
E. Maillet and M. Raveau [1968] 14 p Transl. into ENGLISH from French rept. Presented at the IAEA Symp. on Advan. and Gas-Cooled High-Temp. Reactors, Juelich, 21-25 Oct. 1968
(ORNL-tr-3013, CONF-681008-8) Avail: CFSTI

The development potential for CO_2 turbines and corresponding direct cycles in high-temperature gas-cooled reactors is examined. Cycle design and efficiency and single shaft turbine characteristics are discussed. NSA

N69-27425# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REACTOR PHYSICS Quarterly Report, Oct.–Dec. 1968
Feb. 1969 118 p refs
(Contract AT(45-1)-1830)
(BNWL-985) Avail: CFSTI

A dipping and peaking correction for particle size foils used in thermal fission rate density measurements, a one dimensional diffusion theory program to compute resonance-shielded and collapsed-group cross sections, a code to calculate group constants for nuclear reactor calculations, and a multigroup 3D synthesis code are discussed. Thermal reactor research is summarized with reference to the theoretical correlation of the PRTR Batch Core experiment and Batch Core burnup calculations; experiments with UO_2–4% PuO_2–H_2O lattices; measurement of the value of the ratio of epithermal to thermal neutron capture in U^{238} in UO_2–PuO_2 rods moderated by light water; a numerical method for predicting the converged eigenvalue of a two group, three dimensional diffusion theory calculation; and the Phoenix fuel reactor program. Fast reactors research includes static reactivity calculations for the nuclear proof test reactor (NPTR) annular conical core concept, radiation levels near NPTR fuel, the FTR critical experiments program, shielding considerations, and failed fuel detection. Critical mass studies of $Pu(NO_3)_4$ solutions in slab geometry are also reported. P.A.B.

N69-27428# Sandia Corp., Albuquerque, N. Mex.
SNAP-27 GLFC/FCA AIR DROP TESTS
F. I. Baker Jan. 1969 25 p Sponsored By AEC
(SC-DR-68-890) Avail: CFSTI

Five dummy SNAP-27 Graphite LM Fuel Casks (GLFC's) and one engineering evaluation GLFC/Fuel Capsule Assembly (FCA) were drop tested to obtain an assessment of capsule damage in a probable impact situation in which the capsule was contained in the GLFC. Photographs of the GLFC/FCA at the impact site, photographs of post impact assembly components, and pertinent data are presented. Author (NSA)

N69-27429# Oak Ridge National Lab., Tenn.
PROFIL: A ONE-DIMENSIONAL FORTRAN 4 PROGRAM FOR COMPUTING STEADY-STATE TEMPERATURE DISTRIBUTIONS IN CYLINDRICAL CERAMIC FUELS
C. M. Cox and F. J. Homan Mar. 1969 52 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2443) Avail: CFSTI

A computer program is presented for calculating the radial temperature profile of a cylindrical ceramic fuel pin. Starting at the fuel surface, the temperature rise across each increment is determined from the fission rate, gamma heating rate, density, and thermal conductivity of the material in the increment. The radial positions of columnar and equiaxed grain formation are determined from the nondensified fuel profile. The size of the central void is then calculated from the mass balance. Finally, a densified fuel temperature profile is calculated. Not considered in the calculations are cladding, thermal expansion, and fuel swelling. A FORTRAN 4 source program listing, input instructions, a glossary of variable names, and a sample problem are provided. Author (NSA)

N69-27454# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DEVELOPMENT OF A HIGH-FREQUENCY-HEATED IRRADIATION FURNACE [DEVELOPPEMENT DES FOURS D'IRRADIATION A CHAUFFAGE PAR HAUTE FREQUENCE]
A. Briand 23 Jul. 1968 32 p In FRENCH
(CEA-CONF-1120; Pi(NT)-170-109) Avail: AEC Depository Libraries

Irradiation furnaces were developed which permit the realization, under neutron flux, of very high controlled temperatures up to 2000°C. The history of the induction irradiation furnaces is tabulated, and the generators now in use for in-pile heating are given. Experience gained with these furnaces shows that they have a long operational life (3000 hrs), and each irradiation necessitates the combustion of a specific standard. Author (NSA)

N69-27472# Batelle-Northwest, Richland, Wash. Pacific Northwest Lab.
COMPUTER SIMULATION OF SHORT TERM ANNEALING OF RADIATION DAMAGE IN α-IRON
D. G. Doran, and J. R. Beeler, Jr. (N.C. State Univ.) 16 Oct. 1968 28 p refs Presented at meeting of Am. Phys. Soc., San Diego, Calif., 18-20 Dec. 1968
(Contract At (45-1)-1830)
(BNWL-SA-2124; Conf-681202-1) Avail: CFSTI

The computer simulation of high energy displacement spikes in neutron irradiated α-iron has been reported. The results are strictly applicable only at 0°K. A computer has been developed to simulate short term annealing at relatively low temperatures at which only interstitials are mobile. This code has been expanded to include vacancy motion so as to apply at higher temperatures. Only short range (5th neighbor or closer) interactions are considered. The activation energies were generalized and recent results obtained by the authors; both obtained by computer simulation. The annealing scheme has been applied to three 20-keV displacement spikes. In general, about 80% of the defects are annihilated (in $\sim 10^{-9}$ sec equivalent real annealing time), there is a net decrease in the number of large vacancy clusters, and most of the surviving interstitials become members of small clusters. Author (NSA)

N69-27482# Comitato Nazionale per l Energia Nucleare, Rome (Italy).
ANALYTICAL INVESTIGATION OF CROSSFLOW MIXING BETWEEN OPENED REACTOR CHANNELS
P. Grillo and L. Szabados 1969 22 p refs
(RT/ING(69)2) Avail: CFSTI

Experimental data related to a test section consisting of two adjacent channels, typical of a 19-rod bundle, are analyzed, in order to obtain information on the importance of the mixing phenomenon and to derive the parameters which influence the mixing. Results of calculations show that the total crossflow during non-boiling conditions is independent of gap between fuel rods and depends only on the coolant mass flow rate. This conclusion is qualitatively valid also for boiling conditions, but the total crossflow is higher than for subcooled conditions. The mixing coefficient, defined as a ratio of the enthalpy rise in the opened channel to the enthalpy rise in the total channel, for subcooled flow is independent of gap and mass flow rate and slightly dependent on the average steam quality. The mixing coefficient values for boiling conditions are also reported and observed to be dependent on the gap between fuel rods and only slightly dependent on coolant mass flow rate. Figures are presented showing the total cross flow and mixing coefficient as functions of the average steam quality. P.A.B.

N69-27488# Oak Ridge National Lab., Tenn.
STATUS OF EUROPIUM COMPOUNDS FOR REACTIVITY CONTROL IN NUCLEAR REACTORS
R. J. Beaver and M. M. Martin Feb. 1969 17 p Presented at Mater. Eng. and Sci. Conf. and Exposition, Philadelphia, 31 Mar. - 4 Apr. 1968.
(Contract W-7405-eng-26)
(ORNL-4368; CONF-680324-1) Avail: CFSTI

Europium is an attractive element for controlling excess reactivity in thermal reactors because of its high thermal neutron absorption cross section of 3980 barns and its inherent resistance to irradiation damage. Compounds of europium, particularly europium sesquioxide (Eu_2O_3), europium titanate ($Eu_2Ti_2O_7$), and europium molybdate ($Eu_{5.3}MoO_{11}$), have been developed for these applications. Procedures are described for preparing these compounds and dispersing them in stainless steel and aluminum. Chemical stability, physical properties, and irradiation behavior of these dispersions are reviewed. Author (NSA)

N69-27493# Kresge-Hooker Science Library Services, Detroit, Mich.
STUDY OF DEFECTS PRODUCED IN BERYLLIUM BY IRRADIATION AT LOW TEMPERATURE
J. C. Nicoud et al [1969] 39 p
Transl. into ENGLISH from J. Nucl. Mater. (France), no. 27, 1968 p 147–165
(WAPD-Trans-107) Avail: CFSTI

Samples of beryllium with an overall impurity content of about 0.15% were irradiated at low temperature. The irradiations were carried with either neutrons at liquid nitrogen temperature or electrons at liquid hydrogen temperature. The creation of defects and their subsequent annealing were studied by electrical resistivity measurements. The concentration of defects increase with the integrated flux of incident particles and with the energy of these particles. During isochronous anneslings, four stages of recovery are observed between 20°K and room temperature. After annealing at room temperature the initial resistivity excess is recovered to more than 95%. Isothermal annealings were performed in the different stages between 77°K and room temperature. No simple kinetics were observed. The activation energy measured during the annealing of the defects varies from 0.45 eV around liquid nitrogen temperature to 0.85 eV at about room temperature. Author (NSA)

N69-27494# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
PEGASE REACTOR LOOPS [LES BOUCLES DU REACTEUR PEGASE]
Nov. 1968 115 p In FRENCH
(CEA-R-3564) Avail: AEC Depository Libraries

The first 4 years operation, experimentation and maintenance of the gas loops built especially for the nuclear fuel testing reactor Pegase are described. The reasons for the technical modifications and the way in which they were carried out are also described. Author (NSA)

N69-27522# Scientific Translation Service, Ann Arbor, Mich.
PROBLEMS AND OPTIONS CONCERNING HELIUM TURBINES
Jean Chaboseau and Ennemond Maillet Oct. 1968 15 p Transl. into ENGLISH from French report Presented at IAEA Symp. on Advan. and Gas Cooled High Temp. Reactors, Juelich, West Germany, 21-25 Oct. 1968
ORNL-tr-3011; CONF-681008-6) Avail: CFSTI

The problems of using the direct-cycle turbine design for high-temperature helium-cooled power reactors are analyzed. NSA

N69-27524# Oak Ridge National Lab., Tenn. Isotopes Div.
CONCEPTUAL DESIGN OF A CONTINUOUS THERMAL DIFFUSION PLANT FOR Kr85 ENRICHMENT
K. H. Lin Feb. 1969 34 p refs
(Contract W-7405-eng-26)
(ORNL-4372) Avail: CFSTI

The conceptual design of a continuous thermal diffusion plant for enrichment of fission product krypton with respect to ^{85}Kr is presented. The plant produces enriched material of 45% ^{85}Kr at a rate of 100,000 Ci/year by introducing the feed containing 4% ^{85}Kr through the cascades of thermal diffusion columns. Two alternative cascade arrangements are compared and optimization of the plant is carried out for both designs. The total number of columns required is either 889 or 864 depending upon the design involved. In both designs, the columns are housed in an underground pool that has cooling water circulation. The preliminary cost estimate indicates the fixed capital cost for the plant to be $870,000 and the manufacturing cost exclusive of the feed cost to be $4/Ci. The amount of feed required is estimated at 150,000 Ci/year. Author (NSA)

N69-27525# Oak Ridge National Lab., Tenn.
SENSITIVITY OF GAS AND STEAMED-COOLED-FAST REACTOR BREEDING RATIOS TO UNCERTAINTIES IN Pu-239 CROSS SECTIONS
J. J. Ritts, L. L. Bennett, and F. G. Welfare 12 Feb. 1969 23 p refs
(ORNL-TM-2459) Avail: CFSTI

A study was made to determine the effect of increases in capture cross sections of ^{239}Pu on breeding ratios and fissile loadings of fast reactors. Two sets of comparisons were made showing significant reductions in breeding ratios and increases in fissile loadings. Author (NSA)

N69-27528# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF THE INITIAL CONVERSION RATIO IN AQUILON AND EDF 2 REACTORS [MEASURES DU FACTEUR DE CONVERSION INITIAL SUR LES REACTEURS AQUILON ET EDF 2]
Jean Bergeron, Pierre LeBaud, and Bernard Sautiez Nov. 1968 44 p refs In FRENCH
(CEA-R-3349) Avail: AEC Depository Libraries

In natural uranium fueled reactors, it is important to know the initial conversion ratio, i.e. the ratio of ^{239}U absorption to ^{235}U destruction. The separation of absorption products from fission products is a difficult feature in the measurement of the conversion ratio. A physical method was chosen, the $\gamma\gamma$ coincidence

technique, which uses the properties of the decay scheme of ^{239}Np and allows the Np activity to be separated from the fission product activity, with some corrections. Detectors of natural uranium are used. The accuracy obtained in the measurements is of the order of 2%. Author (NSA)

N69-27544# Oak Ridge National Lab., Tenn.
EFFECTS OF GAS FLOW RATE ON THE MASS TRANSFER COEFFICIENT, MEASURED ACROSS THE LIQUID-SOLID INTERFACE, IN A PACKED-BED CATALYTIC REACTOR USING COCURRENT UPFLOW
J. W. Snider (M. S. Thesis - Tenn. Univ., Oak Ridge) Feb. 1969 123 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2320) Avail: CFSTI

The effect of hydrogen flow rate on the mass transfer coefficient, measured across an α-methylstyrene–palladium interface, was determined in a differential packed-bed reactor using cocurrent upflow of the gas phase and the liquid phase. The palladium catalyst was surface deposited on 0.29-cm-dia alumina spheres. The reactor was operated at 8 and 18 atm of hydrogen pressure. The maximum Reynolds number of the hydrogen was 75, and the Reynolds number of the liquid phase was varied from 13 to 250. The reactor temperature was varied from 23 to 40°C, and the feed composition entering the reactor was varied from 10 to 70 mole percent α-methylstyrene. Three catalyst beds, either 12 or 18 in. in depth, were studied, and it was found that the kinetic rate equation had to be modified to account for differences in the catalytic activities of the beds. Results of this study showed that both the rate of hydrogen transfer to the surface of the catalyst and the kinetic rate at the surface of the catalyst affect the mass transfer coefficient. NSA

N69-27546# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETECTION AND LOCATION OF CAN RUPTURE IN REACTORS COOLED BY A FLOW OF WATER [DETECTION ET LOCALISATION DES RUPTURES DE GAINES SUR LES REACTEURS REFROIDIS PAR CIRCULATION D'EAU]
Roger Le Meur Nov. 1968 26 p refs In FRENCH
(CEA-R-3654) Avail: AEC Depository Libraries

The principal methods of fission-product detection used for water reactors are described. The position, type and method of adjustment are given for each dector. The methods for localizing the defective elements are explained, in particular those using water sampling or decreases in the flux. A few installations are briefly described. They correspond to particular types of reactors using boiling, pressurized or cold water. Among the many methods used, it can be noted that when the fuel is resistant the installations are fairly compact. In nuclear superheated reactors on the other hand, the study of fuel behavior calls for larger installations. An identification of defective elements exists when the reactor structure allows it. If this is not possible, a localization in a group of elements is obtained by a flux depression. Author (NSA)

N69-27561# Commissariat a l'Energie Atomique, Grenoble (France).
POST-IRRADIATION RECOVERY OF TWO HEXAGONAL, FERROMAGNETIC METALS: COBALT AND GADOLINIUM
R. Cope, G. Sulpice, C. Minier, H. Bilger, and P. Moser [1968] 15 p refs Presented at the Conf. on the Phys. of Metals, Berlin, 18-23 Mar. 1968
(CEA-CONF-1028; CONF-680322-1) Avail: AEC Depository Libraries

Co and Gd were bombarded by 3-MeV electrons at 20°K or neutrons at 28°K and the resistivity recovery curve determined after the irradiations. A rather complex defect annealing spectrum was found for both. The kinetics of the defect annealing was studied using different doses. A magnetic after-effect was found for irradiated Co and is associated with the 50 to 60°K resistivity stage, which obeys first order kinetics. The defects responsible for the recovery behavior are discussed. NSA

N69-27562# United Kingdom Atomic Energy Authority, Harwell (England).
ESTIMATION OF THE COMPOSITIONAL AND VOLUME CHANGES IN NOBLE AND REFRACTORY METAL ALLOYS DUE TO NEUTRON IRRADIATION
C. B. T. Braunton, D. N. Hall, and C. M. Ryall Sep. 1968 102 p refs
(AERE-R-5837) Avail: CFSTI

One problem in the selection of thermocouples for irradiation experiments is the possible variation of emf/temperature relationships during irradiation, caused by changes in composition due to transmutation. These changes were calculated for a number of refractory and noble metals and alloys for irradiation periods up to 375 days in termal neutron fluxes ranging from 10^{13} to 10^{15} $n/cm^2/sec$. It was concluded that all the materials investigated will suffer significant changes in composition during irradiation, and that both the thermoelectric and dimensional stability are therefore suspect. Author (NSA)

N69-27563# Scientific Translation Service, Ann Arbor, Mich.
PURIFICATION OF HELIUM IN HIGH TEMPERATURE REACTORS WITH A HELIUM EXPANSION CYCLE
Bruno Grison and Guy Simonet Oct. 1968 19 p refs Transl. into ENGLISH from French report Presented at IAEA Symp. on Advan. and Gas Cooled High Temp. Reactors, Juelich, West Germany, 21-25 Oct. 1968
(ORNL-TR-3012; CONF-681008-7) Avail: CFSTI

Purification systems for He-cooled high-temperature power reactors are described. A comparison of systems is made for reactors without a direct helium cycle and for reactors with a direct helium cycle and cooling by helium expansion. NSA

N69-27566# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
INTEGRAL TARGET FUEL IN A WATER COOLED GRAPHITE LATTICE: THEORY-EXPERIMENT CORRELATION
C. L. Bennett 31 Jul. 1968 59 p refs
(Contract AT(45-1)-1830)
(BNWL-804) Avail: CFSTI

A complete multi-group S_n transport theory analysis and comparison with experiment was made for an integral target fuel in a water-cooled graphite lattice, including the investigation of the leakage effect on k_∞. Emphasis was placed on the magnitude, relative importance, and recommended improvements of errors in the theory-experiment comparisons due to either the models or methods used. The improved techniques give results that are in reasonably good agreement with most of the measured lattice parameters. Author (NSA)

N69-27584# Oak Ridge National Lab., Tenn.
DESIGN CURVES FOR BURNOUT HEAT FLUX IN FORCED-CONVECTION SUBCOOLED LIGHT-WATER SYSTEMS
W. R. Gambill 14 Nov. 1968 31 p refs Supported by AEC
(ORNL-TM-2421) Avail: CFSTI

Design (minimum) values of burnout heat flux for subcooled water systems are calculated. The calculated fluxes are not reduced with an arbitrary design factor; instead, each term is modified to coincide with the lower bound of available experimental data--i.e., established scatter limits are applied to each factor separately.

Burnout fluxes are plotted for $10 < V < 100$ fps, $15 < P < 3000$ psia, $100 < \Delta t_{sub} < 400°F$, and channel equivalent diameters of 0.1 and 0.5 in. A simple method is described for estimating the ratio of burnout to incipient-boiling heat fluxes. The method is applied to the HFIR to indicate the dependence of the subject flux ratio on velocity, subcooling, and pressure. Author (NSA)

N69-27585# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PHYSIC ASPECTS OF THE PRTR BATCH CORE EXPERIMENT
M. A. Mannan 1 Nov. 1968 25 p ref
(Contract AT(45-1)-1830)
(BNWL-SA-2192) Avail: CFSTI

The reactor physics programs for the utilization of Pu in thermal power reactors conducted at the Pacific Northwest Laboratories are reviewed. The Plutonium Recycle Test Reactor is described, and the critical and irradiation experiments conducted with the 55-element UO_2-PuO_2 batch core loading are analyzed. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-26244# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF SOUND-FIELD STRUCTURES IN CLOSED CABINS AND COMPARTMENTS BY MEANS OF CORRELATION METHODS
L. V. Dmitrieva and N. N. Pisarevskii 3 Jul. 1968 9 p refs Transl. into ENGLISH from Russian Conf. Repts. Presented at the Conf. on Noise and Vibration Control by Means of Struct. Acoust. Method, Chelyabinsk, USSR, 1966
(AD-683370; FTD-HT-23-428-68) Avail: CFSTI CSCL 20/1

The main characteristics of acoustic fields in closed rooms and compartments are determined from a space-time correlation function by measuring acoustic pressures at two points. The character of the correlation function between acoustic pressures and the spacing between the two points makes it possible to evaluate irregularities in the acoustic-energy flux. The correlation functions are found by two methods, called the radial and angular correlation method; in some cases, radial and angular correlation functions are insufficient for characteristizing the acoustic-field structure. Isocorrelation curves for several sections are then plotted. This is demonstrated with an example of an aircraft fuselage. The sound field was established by means of a loud speaker placed in the fuselage. Measurements were made in the octave region of white noise at an average frequency of 800 Hz, and the correlation coefficients were registered when one microphone was located in the cabins center and another was moved automatically. The measured isocorrelation curves are shown. Author (TAB)

N69-26268# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
MEASUREMENT OF WAVE NUMBER SPECTRA [MESURE DES SPECTRES DE NOMBRE D'ONDE]
Francoise Perceval (Ph.D. Thesis) Mar. 1969 99 p refs In FRENCH; ENGLISH summary
(CEA-R-3740; EUR-4112.f) Avail: CFSTI

To measure wavelengths in an ionized medium, the cross-correlation product of the signal received by a fixed probe and that received by a movable one exploring the medium, is obtained with an interferometer. In order to determine the various modes a device which computed the Fourier transform of the signal was constructed. The influence of the phase at the origin, of the damping of the signal and of the finite explored length has been studied in order to make a numerical calculation of the Fourier transform. Author (ESRO)

N69-26269# Centre National de la Recherche Scientifique, Marseilles (France). Laboratoire de Technologie Optique.
SPECTROPHOTOMETRICAL CALIBRATION OF DEUTERIUM LAMPS: COMPARISON WITH A BLACK BODY [ETUDE SPECTROPHOTOMETRIQUE DE LA LAMPE A DEUTERIUM: COMPARAISON AU CORPS NOIR]
Hua Chon-Trung May 1968 62 p refs In FRENCH
Avail: CFSTI

After summarizing the properties of different radiation sources that have been analyzed by spectophotometric methods during recent years, particularly their ability to radiate in the near and far ultraviolet regions, a method is described for comparing unknown sources with standard ones so linking them with a black body of known temperature. It is shown experimentally that the color temperature of a deuterium lamp is of the order of 20,000°K in the 3700–3100Å range. ESRO

N69-26278# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROPAGATION OF MODULATED LIGHT RADIATION IN A SEMI-INFINITE ISOTROPIC SCATTERING MEDIUM
I. L. Katsev 1969 7 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR) v. 10, no. 1, 1969 p 120–125
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An isotropic semi-infinite scattering medium, exposed to an instantaneous light pulse along the normal to the surface, is considered. The nonstationary transport equation is solved in a two flux approximation. The phase shift occurring in the propagation of modulated light signals in the scattering medium is investigated, and the dependence of the phase shift and degree of modulation on the angle of observation analyzed. The phase shift grows substantially, with a concurrent decrease in degree of modulation, for all angles of observation as the optical depth increases. Phase shift also increases as the probability of photon survival increases. The onset of a depth regime for greater optical depth and the elongation of the directivity pattern in the depth regime with increased modulation frequency are discussed. The influence of the probability of photon survival on the accuracy of determining the attenuation index by a phasemeter method is also considered. P.A.B.

N69-26283 Clark Univ., Worcester, Mass.
DOMAIN SWITCHING IN IRRADIATED FERROELECTRIC KH_2PO_4 OBSERVED BY ELECTRON SPIN RESONANCE
Raymond Charles DuVarney, Jr. (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-17226

While potassium dihydrogen orthophosphate KH_2PO_4 (KDP) is a well known ferroelectric material, very little work has been published concerning the effects of radiation on it. This work reports results of some radiation damage studies in which Electron Spin Resonance (ESR) is used as a probe to study the microscopic radiation-damage sites and to observe the influence of an applied electric field on these sites. It is found that the switching of the ferroelectric domains can be observed directly on the microscopic level and that the observed damage sites are themselves microscopically reversible. At room temperature, KDP forms tetragonal

crystals (space group 142d) in which each tetrahedral orthophosphate (PO_4^-) group is hydrogen-bonded to its four neighboring PO_4^- groups. Radiation-damaged KDP exhibits strong ESR signals when irradiated and studied at 77°K. It is concluded that the polarization mechanism is able to transfer the unpaired electron spin density from an upper oxygen site to a lower oxygen site or vice versa. Using the ESR spectrum, then, to indicate the degree of polarization in a sample it is also found that X-irradiation of a polarized crystal causes a loss of polarization, possibly due to radiation effected domain wall migration. Dissert. Abstr.

N69-26287 Kansas Univ., Lawrence.
INTERACTIONS BETWEEN PARAMETRICALLY EXCITED SPIN WAVES IN YTTRIUM IRON GARNET
John David Bierlein (Ph.D. Thesis)
1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilms $3.00 Order No. 68-17358

An experimental and theoretical study has been made of the effects of spin wave-spin wave interactions in magnetic insulators at high power levels. Both transient and steady-state data are presented for the transverse magnetization and the second harmonic part of the longitudinal component of magnetization. The theory presented is an extension of the normal mode theory and includes the effects of higher order spin wave interactions. Experiments were performed on highly polished single crystal YIG spheres at a fundamental frequency of 8.42 GHz, and several anomalies were observed above the second Suhl threshold: (1) a minimum in the steady-state second harmonic radiated power as incident power increases beyond threshold; (2) the appearance of a sizable variation in the initial transient portion of the second harmonic pulse with no apparent variation in the transverse magnetization; and (3) a reradiation region on the trailing edge of the second harmonic pulse after the transverse magnetization has decayed to a small value. The spin wave contribution to the second harmonic was also experimentally determined. The spin wave linewidth was measured and compared using susceptibility decline, second harmonic decay, and parallel pumping techniques Dissert. Abstr.

N69-26306*# Aztec School of Languages, Inc., Maynard, Mass.
SOUND INTENSITY MEASUREMENTS ON FREE JETS FROM SLOTTED NOZZLES WITH AND WITHOUT REFLECTOR SHIELDS [SCHALLMESSUNGEN AN LUFTFREISTRAHLEN AUS SCHLITZDUESEN MIT UND OHNE ABSCHIRMUNG]
Washington NASA Apr. 1968 23 p refs Transl. into ENGLISH from German Paper 68-33 Presented at 6th Congr. of the Intern. Council of the Aeron. Sci., Munich, 9–13 Sep. 1968
(Contract NASw-12138)
(NASA-TT-F-12138) Avail: CFSTI

Study of sound intensity measurements in the acoustic far field for cold free jets of air which are emitted from slotted nozzles. The free jets are characterized by a velocity of Mach 0.98 and a cross sectional area of approximately 1 cm The measurements are carried out for free jets which are in one case subsequently reflected and in the other case not reflected. The influence of the length of the reflector and the distance between reflector and the axis of the jet is investigated. It is shown that additional unwanted noise is generated by the use of short reflectors or by placing the reflector close to the free jet. Author

N69-26307*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
CORRELATION OF FLUCTUATING FORCES WITH THE SOUND RADIATION FROM RIGID FLOW SPOILERS
Hanno H. Heller, Sheila E. Widnall, and Colin G. Gordon Washington NASA May 1969 118 p refs
(Contract NAS1-7552)
(NASA-CR-1340; BBN-1734) Avail: CFSTI CSCL 20A

Results of a theoretical and experimental study of the correlation of fluctuating forces on rigid flow spoilers and the resulting sound radiation are presented. For this experiment, we developed a system of force transducers to measure simultaneously, yet independently, the drag and lift components of the fluctuating forces on flow spoilers within an experimental jet pipe system. The results of the study suggest strongly that spoiler-generated noise is of dipole character, since a direct correlation of fluctuating forces with the radiated sound was found. For evaluation of the data, a theory was developed to predict the sound power radiated from pipe-immersed flow spoilers. This theory considered the effect of the enclosure upon the sources and the effect of pipe end reflection. Both monopole and dipole sources were treated. An increase of the dipole sound power output by a factor of 3 for frequencies below the pipe cut-off frequency was predicted and experimentally confirmed. Author

N69-26375# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
OPTICAL CONSTANTS OF FULLY IONIZED PLASMAS FOR THE RADIATION OF RUBY, NEODYMIUM-GLASS, AND CARBON DIOXIDE LASERS
Heinrich Hora and Hannelore Müller Nov. 1968 35 p refs
(IPP-3/81; IPP-6/71) Avail: CFSTI

The refractive index n and the absorption constant K are numerically evaluated for fully ionized plasmas with atomic numbers Z = 1 to 4 as functions of the electron temperature T and atomic density N for the case of ruby, neodymium-glass, and CO_2 laser radiation and for the second harmonics of each type of radiation on the basis of the two-fluid model of hydrodynamics using Spitzer's collision frequency α. Author (ESRO)

N69-26506 Oklahoma Univ., Norman.
THE MAGNETO-OPTIC AND ELECTRICAL PROPERTIES OF HYDROUS FERRIC OXIDES
Joseph Charles Calusio (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-17476

The Faraday rotations of nine stabilized ferric hydroxides have been measured in the wave number range of 12,500–27,400 cm^{-1}. The frequency dependence of the rotation can be understood in terms of current theoretical predictions. The magnetic field dependence has been analyzed, a superparamagnetic rotation can be distinguished. Faraday effect measurements for vacuum deposited thin films of iron, cobalt and nickel are also presented. The optical absorption spectra of solutions of the hydrous ferric oxides were measured and the positions of the major and weak absorption maxima were found. The extinction coefficient in the range of 15,000 to 50,000 cm^{-1} reaches a value of 10,000 cm^{-1} mol^{-1} liter) in the UV. Dissert. Abstr.

N69-26525*# Wyle Labs., Inc., El Segundo, Calif. Research Staff.
AN INVESTIGATION TO LOCATE THE ACOUSTIC SOURCES IN A HIGH SPEED JET EXHAUST STREAM
R. C. Potter Feb. 1968 50 p refs
(Contract NAS 8-21060)
(NASA-CR-101105; WR-68-4) Avail: CFSTI CSCL 20A

A small high speed (Mach 2.5) cold jet was operated with the exhaust stream passing through a hole in the wall of a 100,000 cubic foot reverberation room. The reverberant sound pressure level was measured to allow determination of the total acoustic power generated by the flow inside the room. The jet nozzle was then progressively withdrawn, so that a smaller amount of the mixing flow was retained within the room. The experiment was repeated with the jet inside the room, with the flow directed outwards, and with the jet nozzle moved back into the room. The resultant

acoustic power curves were differentiated to give the acoustic power generated per unit length of the jet flow. The results for the total acoustic power and octave band power distributions are presented and experimental details reviewed. It is concluded that the flow near the supersonic core tip is responsible for the majority of the noise generated. Author

N69-26541 University of Southern Calif., Los Angeles.
VACUUM ULTRAVIOLET RADIATION STUDIES FOR PHOTOABSORPTION BY MODERATE TEMPERATURE PLASMAS
Harvel Eugene Blackwell (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-17015

Techniques for the study of photoabsorption by moderate temperature plasmas have been investigated with particular reference to the high current, wall-stabilized, cascade arc. Observations of plasma emission and absorption were made in the wavelength region below 1000 Å where the wavelengths corresponding to the ionization threshold energies of most atoms and molecules occur. Studies were made with argon, neon, hydrogen, and oxygen. Argon and hydrogen exhibit strong Stark-broadened line emission, and the recombination of the singly ionized atoms and electrons yields a strong emission continuum. The transmission coils, vacuum ultraviolet spark source radiation through the plasma of the arc, as through the shock tube plasma, will make possible accurate photoionization cross section measurements of ionized plasma constituents and of atomic constituents chemically unstable under normal conditions. Dissert. Abstr.

N69-26619# Pennsylvania State Univ., University Park. Ordnance Research Lab.
CORRELATION STUDY OF THE UNDERWATER DIFFRACTION PATTERN OF A CORRUGATED AIR-WATER INTERFACE
J. G. Duffy, Jr. Washington, D.C. Naval Ordnance Systems Command 25 Jul. 1968 82 p refs
(Contract NOw-65-0123-d)
(AD-683783; TM-215.2221-05) Avail: CFSTI CSCL 20/1

This experimental investigation examines the underwater diffraction pattern of a corrugated surface insonified by a warbletone (wide band FM) acoustic source. Sound field data is obtained using a variable-level correlation system to measure the pressure amplitudes of the first two forward and back-scattered orders. These measurements are carried out primarily for frequencies near those for which the various scattered orders fail to appear e.g. near the cut-off frequencies. Author (TAB)

N69-26696 Cornell Univ., Ithaca, N.Y.
FLUX CREEP IN HARD SUPERCONDUCTORS
Malcolm Roy Beasley (Ph.D. Thesis)
1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-16734

Flux creep in the critical state of some typical hard type 2 superconductors has been investigated in order to improve the basic understanding of the flux creep process and to assess the usefulness of flux creep measurements as a probe of the basic fluxoid pinning mechanisms. The measurements were made using a very sensitive magnetometer incorporating a superconducting quantum interference device as the flux sensing component. The details of this system are described, and its general usefulness and limitations are discussed. The observed flux changes showed the logarithmic time dependence characteristic of the flux creep, and the creep rate $d\phi/d \log t$ was studied as a function of magnetic history, cold working, specimen size, and to some extent temperature. Dissert. Abstr.

N69-26697# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ORGANIC ABSORPTION LIGHT FILTERS OF THE CUTOFF TYPE FOR THE SPECTRAL REGION 310–600 nm
M. A. Okatov et al 30 Jul. 1968 12 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 7, no. 4, 1967 p 638–643
(AD-683114; FTD-HT-23-476-68) Avail: CFSTI CSCL 20/6

The authors describe new light filters of the cutoff type, which absorb short-wave radiation and transmit the long-wave part of the spectrum. The base of the filter was polymethylmethacrylate, and the light-absorbing additives were derivatives of cyclopropene, benzophenone, ethers of substituted benzoyl and benzalcyanacetic acids, as well as a number of new compounds from the flavon, coumaran, fourocoumaran, and other compounds. Altogether, sixty-five different substances were tested, some for the first time. The filters were produced by a standard technology and tested for moisture absorption heat endurance, and optical properties. A table listing the transmission edge of the most typical filters (defined as the wavelength at which the transmission coefficient is half the maximum value) and plots of the transmission curves are presented. Most filters have an optical density exceeding 3 and a transmission of 92% in the working region. Methods of shifting the transmission edge by varying the amount of chemical additive are discussed. TAB

N69-26724 Stanford Univ., Calif.
FADDEEV'S EQUATIONS FOR LOCAL POTENTIALS
Thomas Arthur Osborn (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-15086

The dissertation studies the non-relativistic quantum mechanical three-body problem. The three particle system is that described by three spinless particles interacting via a sum of two-body potentials. The dynamics of the system is determined by Schroedinger's equation. Recently L. D. Faddeev has shown how to re-express this equation in a form which is well defined and avoids the singularities which customarily accompany the three particle Schroedinger equation. Faddeev's work shows that solutions to the problem exist but does not obtain any of these solutions. Subsequent research has obtained specific numerical solutions under the assumption that the two-body potential is separable in momentum space. Dissert. Abstr.

N69-26736# California Univ., Los Angeles. Dept. of Engineering.
SCATTERING BY COATED PROLATE SPHEROIDS
C. Yeh Jan. 1969 25 p refs
(Contract N00014-67-A-0111)
(AD-683721; Rept-69-5) Avail: CFSTI CSCL 20/1

The exact solution of the diffraction of plane sound waves by a rigid prolate spheroid coated with a confocal sheath of penetrable acoustic material is obtained. Results are given in terms of spheroidal functions. Detailed numerical computations for the radiation patterns of the scattered wave are carried out for certain acoustic parameters. It is found that the coating alters quite significantly the scattering characteristics of an incident wave. Furthermore, because of the coupling between each expansion coefficient for the scattered wave with all expansion coefficients for the incident wave for the coated spheroid case, the Watson transformation technique cannot be used directly to yield expressions which are applicable at high frequencies. Author (TAB)

N69-26751# Israel Program for Scientific Translations, Ltd., Jerusalem.
UKRAINIAN PHYSICS JOURNAL, VOLUME 12, NUMBER 3
V.E. Lashkarev ed. 1967 180 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 12, no. 3, Mar. 1967 Published for AEC and NSF Its Ipst Cat. No. 5063
(TT-67-51421/3; AEC-tr-6869/3) Copyright. Avail: CFSTI

Articles and brief notes are presented on research in group theory, solid state, atomic nuclear, plasma, and particle physics. For individual titles, see N69-26751 through N69-26800.

N69-26758 Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF MOBILITY OF CURRENT CARRIERS IN SOLIDS DURING THE PASSAGE OF A SOUND WAVE
Yu. V. Kornyushin
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 395-398 (See N69-26751 14-23) refs
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The case is considered when the sound wavelength is considerably greater than the free path of current carriers in a solid. The gradually varying force field of the sound wave as seen by the current carriers is then introduced in the equation of diffusion and conduction together with the external homogeneous electric field. The equations for the effect of sound waves on mobility are then solved for nondegenerate semiconductors and metals, using Boltzmann statistics and Fermi-Dirac statistics respectively. B.P.

N69-26759# Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF ELECTRICAL CONDUCTIVITY FOR IMPURITY SCATTERING OF CURRENT CARRIERS
V. I. Marusyak
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 399-403 (See N69-26751 14-23) refs
Copyright. Avail: CFSTI

The general kinetic equation for irreversible processes was derived and an investigation was made of the structure of the collision term. This was done by Laplace transforming the correlation term and expanding it into an asymptotic series. An average was made over the impurity configurations, followed by a summation. The theory was based on Kubo's formula for the static conductivity tensor, where the current density operator is a Heisenberg representation. B.P.

N69-26760# Israel Program for Scientific Translations, Ltd., Jerusalem.
FIELD EFFECT IN THE PHOTOCONDUCTIVITY OF PURE SILICON IN THE INFRARED
V. P. Kovbasyuk et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 404–413 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The photoconductivity was measured for n-type and p-type silicon specimens in a vacuum at temperatures of 295°K and 110°K. The infrared radiation was modulated at 20 Hz. The variation of the IR impurity photoconductivity with the external electrical field was studied for three types of electron transitions (accumulation, depletion, inversion) for three characteristic surface states of an n-type semiconductor. B.P.

N69-26761# Israel Program for Scientific Translations, Ltd., Jerusalem.
MOMENTS OF MAGNETIC RESONANCE LINES IN LIQUIDS
D. G. Dolgopolov et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 414–420 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

A generalization was made to Van Vleck's method of moments by introducing the radial distribution functions of particles in a liquid. The resulting relations were then adapted to study the resonance line profiles and line widths and to estimate relaxation times in liquids. B.P.

N69-26770# Israel Program for Scientific Translations, Ltd., Jerusalem.
LIGHT SCATTERING BY ISOVISCOUS SOLUTIONS OF N-PARAFFINS
G. P. Roshchina et al
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 459-461 (See N69-26751 14-23) refs
Copyright. Avail: CFSTI

Density scattering intensity results are reported for octane nonane, and undecane systems at 20.55, and 87°C. The isothermal compressibility and refractive indices for these isoviscous liquids are also tabulated. B.P.

N26-26772# Israel Program for Scientific Translations, Ltd., Jerusalem.
ABSORBPTION OF SOUND NEAR THE CRITICAL POINT IN A PURE LIQUID
Yu. P. Krasnyi et al
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 462-464 (See N69-26751 14-23) refs
Copyright. Avail: CFSTI

Strong absorption of sound and ultrasound waves is observed near the critical point of pure substances. It is shown that this effect is almost entirely due to the anomalous increase in bulk viscosity. A dispersion equation of a sound wave is derived for this phenomenon. B.P.

N69-26775# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRICAL TRANSFER AND RESISTIVITY IN THE LIQUID Sn-Ga SYSTEM
P. P. Kuzmenko et al
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 467-469 (See N69-26751 14-23) refs
Copyright. Avail: CFSTI

The concentration dependence of the resistivity and the electrical transfer parameter Z^* of the Sn–Ga system at 300°C were measured. The resistivity was measured by the capillary method. Radioactive tin was used to investigate electrical transfer. The electrical transfer parameter Z^* is determined from the steady-state distribution of radioactive tin in the anode and cathode halves of the capillary specimen. Author

N69-26788# Israel Program for Scientific Translations, Ltd., Jerusalem.
A STUDY OF DOMAIN WALL ENERGY AS A FUNCTION OF THE ANGLE BETWEEN THE MAGNETIZATION VECTORS OF ADJACENT DOMAINS
V. N. Pushkar et al
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 500-502 (See N69-26751 14-23) refs
Copyright. Avail: CFSTI

Experimental verification was undertaken of the approximate relations for Neel and Bloch walls which express the dependence of wall energy on the angle between the magnetization vectors of adjacent domains. The wall displacement field was measured as a function of a constant magnetic field applied at right angles to the wall. Experiments were carried out using very thin films with Neel wall boundaries, and thick films with Bloch wall boundaries. The data for thick films are plotted and are found to be in good agreement with theory. Magnetization reversal of very thin films was investigated with the aid of the EM-7 electron microscope adapted to magnetic structure observations. The results are in full agreement with the critical magnetization-reversal curve, showing that the critical curve of thin films is determined by the angular dependence of the field of formation of magnetization-reversal embryos. P.A.B.

N69-26794# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE KINETICS OF FIELD EFFECT ON A CLEAN GERMANIUM
A. I. Klimovskaya et al
In its Ukrain. Phys. J., Vol. 12, No. 3 1967 p 513-515 (See N69-26751 14-23) refs
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The relaxation time of surface conductivity produced by an external electric field was measured using the compensation bridge method. The experimental setup is outlined, its sensitivity was sufficient to detect steady-state variation of conductivity. The main conclusion of the experiments was that the fast relaxation time of surface conductivity induced by the external electric field is less than 5.10^{-7} sec; it remains in this range as the temperature is lowered to 100°K and increases to 10^{-6} sec with surface oxidation. Oxidation simultaneously gives rise to slow relaxation. Calculation of the lower limit of the hole capture cross section is discussed. P.A.B.

N69-26879# Royal Aircraft Establishment, Farnborough (England).
INTERFEROMETRIC MEASUREMENTS ON PHASE STRUCTURES FOR HOLOGRAPHY [INTERFEROMETRISCHE MESSUNGEN AN PHASENSTRUKTUREN FUER DIE HOLOGRAPHIE]
H. Hannes Nov. 1968 23 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 26, no. 4, 1967/1968 p 363-380
(RAE-Lib-Trans-1323) Avail: CFSTI

The analysis of phase objects with very small path differences by interference microscopy is described with particular reference to the detection of slight variations of refractive index in addition to a pronounced surface relief. Photographic emulsions exposed to two-beam interference and bleached after developing and fixing served as test objects and as a model for a phase hologram. The exterior and interior components of the one-dimensional grating relief thus obtained were measured separately and as a function of spatial frequency. With low spatial frequencies the exterior relief predominates, with high frequencies the interior relief. Author

N69-26905# Israel Program for Scientific Translations, Ltd., Jerusalem.
UKRAINIAN PHYSICS JOURNAL, VOLUME 12, NUMBER 4
V. E. Lashkarev, ed. 1969 181 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), V. 12, No. 4, Apr. 1967 Published for AEC and NSF *Its* IPST Cat. No. 5064
(TT-67-51421/4; AEC-tr-6869/4) Copyright. Avail: CFSTI

A collection of Soviet scientific studies is presented with emphasis on nuclear and molecular theory, crystal and semiconductor electronic properties, plasma dynamics, and ferromagnetic properties of metal compounds. For individual titles, see N69-26905 through N69-26936.

N69-26921# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERFERENCE MEASUREMENTS OF THE DISPERSION OF SOLIDS
V.N.Malinko et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 626-631 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

The present report describes an improved interference method for high-accuracy refractometry using prism optics. The interference measurements are based on the well-known fact that a plane-parallel plate mounted before the slit of the spectroscopic instrument will give an interference pattern superimposed on the spectrum. The light rays hitting the plate must be parallel or make a very small angle with one another. For each interval there is a certain optimal plate thickness giving a sharp interference pattern with numerous maxima and minima. An excellent table of thicknesses applicable to all mass-produced IR prism spectrophotometers and spectrometers is developed. The condition of parallel beam interference is $2n_\nu d\nu = N$, where d is the plate thickness in cm, ν the frequency in cm^{-1} n_ν the refractive index at the given frequency, N the order of interference (an integer for maxima and a half-integer for minima). n_ν is then calculated from the preceding equation, if all the other quantities are known. The frequencies of interference maxima depends mainly on the calibration accuracy of the apparatus, which for IR spectrophotometers can easily be made as high as 0.1%. The resulting error in the refractive index is 1 in 10^3. Author

N69-26923# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE EFFECT OF THERMAL CONDUCTIVITY ON THE RF PROPERTIES OF ANTIFERROMAGNETICS WITH A WEAK TRANSVERSE FERROMAGNETISM
F.G. Petrov *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 639-645 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

Following a mathematical examination of the problem, it is concluded that the spin-wave damping due to thermal conductivity is proportional to t^3 at low temperatures. Further because of the weak transverse ferromagnetism, it is shown that the equilibrium magnetic moments of the sublattices are not antiparallel when the field $H_0 = 0$. The deviations m_i of the magnetic moments from equilibrium are thus not perpendicular to the vectors A_i, so that the thermal conductivity influences the spin-wave damping in the absence of magnetic field as well. In an antiferromagnetic with mirror-image sublattices, the equilibrium magnetic moments are strictly parallel and the damping is independent of thermal conductivity. K.R.G.

N69-26926# Israel Program for Scientific Translations, Ltd., Jerusalem.
MICROSTRUCTURE OF COPPER-MANGANESE FERRITES
A. I. Andrievskii et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 658-661 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

Phase composition, grain size, and porosity were studied for a number of specimens having the initial composition $mCuFe_2O_4\ nMnFe_2O_4$, where $m = 0.1, 0.2, 0.3, 0.4, 0.5, 0.55, 0.6, 0.7, 0.8, 0.9$, and 1.0 and $n = 1 - m$. X-ray analysis of these specimens has shown that the ferrites obtained by sintering the component oxides Cu_2O, MnO_2, and Fe_2O_3 are single phase systems with a spinel-type lattice. The lattice parameter of various specimens, determined by the back reflection technique, is a function of composition, and the blurring of the large-angle diffraction maxima points to insufficient homogeneity of the system within a single system. The structure of copper–manganese ferrites of various compositions was studied by metallography of the outer surface which had been polished before the final annealing. The microstructure was examined under a metallographic microscope. At high temperatures (1250°C), the Cu–Mn ferrites sinter into polycrystalline material with crystallites measuring from a few microns to 0.5 mm. K.R.G.

N69-26927# Israel Program for Scientific Translations, Ltd., Jerusalem.
X-RAY STUDY OF NONSTOICHIOMETRIC MAGNESIUM-MANGANESE FERRITES OF THE SPINEL TYPE
P. P. Kirichok *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 662-665 refs (See N69-26925 14-23)
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The valence of ions and the influence of chemical composition on the nature of the interatomic bond in nonstoichiometric magnesium–manganese ferrites was determined by X-ray methods.

The study proceeded from Kunzl's rule, according to which the K absorption edge shifts in the direction of short waves as the valence of the ion in an oxygen compound increases. MgO–MnO–Fe_2O_3 ferrites were prepared by the usual ceramic technology. The starting materials were magnesium oxide (AP), modulated oxide (AP), and manganese carbonate, prepared from manganese nitrate by precipitation with ammonium carbonate. X-raying of the MgO–MnO–Fe_2O_3 specimens revealed them to be single-phase solid solutions of the spinel structure. The K-edge energy was determined by the Johann–Kapitsa curved crystal technique. K.R.G.

N69-26928# Israel Program for Scientific Translations, Ltd., Jerusalem

NEW PROPERTIES OF LIQUIDS

B. V. Deryagin *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967, p 666–677 refs Presented at the 7th Conf. on the Phys. of the Liquid State, Kiev, 1967 (See N69-26905 14-23)

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The current theories of the liquid state combine a variety of features which are close to the properties of both gases and solids. Accordingly, the nature of the thermal molecular motion in liquids is thought fundamentally similar to that in solids. There is, however, a large quantitative difference in the characteristics of low-molecular liquids and those of glassy or crystalline solids; it is estimated that the relaxation time of water and benzene is about 10^{-10} sec. Special significance is therefore attached to experimental findings that reveal the existence of much slower relaxation processes under sufficiently small deformations. This existence of slow relaxation is deduced from resonance studies of the bulk shear modulus previously carried out. Also, a number of polar liquids were obtained in a modified form, with vapor pressures a few percent below the standard tabular values. Thus at a given temperature, water and methanol may exist in two different stable states with different short-range order. This structural polymorphism suggests that liquids are even more solid-like than it follows from current concepts. K.R.G.

N69-26929# Israel Program for Scientific Translations, Ltd., Jerusalem.

VISCOSITY AND DENSITY OF NORMAL MONOBASIC ALCOHOLS AT LOW TEMPERATURES

V. G. Komarenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 678–683 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

Systematic measurements were made of viscosities and densities of methanol, ethanol, and butanol from +25°C to the triple point and of propanol from +25° to −120°C. The specimens used were 99.94% methanol, 99.95% ethanol, 99.98% propanol, and 99.96% butanol. The density was measured pycnometrically with a maximum error of 0.1%. The pycnometer was a glass flask of 50 cm^3 capacity with small spheres (each of 1–1.5 ^{3} cm) welded to it in a vertical array and joined by short graduated capillaries (2 mm bore). The volumes were graduated using water at room temperature. The pycnometer was filled and sealed so that only a small space remained above the liquid, and the temperature being known, the density of the alcohol was calculated with allowance for the expansion of the glass. The pycnometer was suitable for density measurements in the entire temperature range and it did not require replenishment of alcohol. The viscosity was determined by the capillary method. K.R.G.

N69-26930# Israel Program for Scientific Translations, Ltd., Jerusalem.

NONLINEAR DIFFUSION IN SOLUTIONS NEAR THE CRITICAL POINT

N. P. Kovalenko *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 684–686 refs (See N69-26905 14-23)

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The diffusion in a nitrogen–CO_2 mixture near the liquid–vapor critical point was described in a previous report. A finite time lag was observed, a period of extremely slow diffusion followed by an abrupt increase in the rate of the process, after which the diffusion resumed the normal trend. This communication attempts to mathematically treat and interpret the two-stage diffusion near the critical point as a nonlinear system. K.R.G.

N69-26934# Israel Program for Scientific Translations, Ltd., Jerusalem.

IRON K ABSORPTION SPECTRUM OF GARNET FERRITES

P. P. Kirichok *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 693–695 refs (See N69-26905 14-23)

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The X-ray analyses were carried out on a polycrystalline yttrium ferrite of stoichiometric composition. Yttrium ferrite specimens were manufactured by the ordinary ceramic technology. A mixture of yttrium oxide and iron oxide (AP) was milled for two hours. The mixture was then dried, pressed, and prefired at 900°C for five hours. After firing the briquettes were again powdered, pressed, and fired at 1380°C in the air for four hours. After repeated firing, the specimens were slowly cooled with the kiln in the air. X-ray absorption targets and specimens for X-ray tests were prepared from this polycrystalline yttrium ferrite and also from yttrium crystals. Results are presented in graphic form. K.R.G.

N69-26935# Israel Program for Scientific Translations, Ltd., Jerusalem.

DISTRIBUTION OF CURRENT, MAGNETIC FIELD, AND TEMPERATURE IN A PLANE LAYER WITH TEMPERATURE-DEPENDENT CONDUCTIVITY IN A CONSTANT TANGENTIAL ELECTRIC FIELD

R. S. Kuznetskii *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 695–698 refs (See N69-26905 14-23)

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A theoretical treatment is presented of stationary electric and magnetic fields and the distribution of current and temperature in a conductor without extraneous current and heat sources, based on Maxwell's equations and the equation of heat conduction. Pure exponential functions describing the distributions are derived. K.R.G.

N69-26936# Israel Program for Scientific Translations, Ltd., Jerusalem.

ASYMPTOTIC BEHAVIOR OF SPECTRAL DENSITY IN THE NONRENORMALIZABLE THEORY

M. Sh. Pevzner *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 698–700 refs (See N69-26905 14-23)

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Propagators constructed by the peratization technique in the nonrenormalizable theories are less singular on the light cone than the free propagators. This contradicts the Kaellen-Lehman conditions. A similar situation arises also in summing the perturbation-theoretical series in renormalizable theories. There are two points of view on why the axiomatic approach breaks down: (1) the initial Hamiltonian in non-physical and (2) the approximation method has been poorly chosen. This paper investigates the second point of view and following a theoretical treatment concludes that no spectral representation with a finite number of residues can be written for the propagator in the nonrenormalizable theory. The paper further states that the nonrenormalizable theory is thus not amenable to any local interpretation. K.R.G.

N69-27114# Iowa State Univ. of Science and Technology. Ames Lab.
FREQUENCY DEPENDENCE OF THE MAGNETIZATION OF GADOLINIUM IN THE NEIGHBORHOOD OF THE FERROMAGNETIC ORDERING TEMPERATURE
Farley Olander (M.S. Thesis) Nov. 1968 85 p refs
(Contract W-7405-eng-82)
(IS-T-281) Avail: CFSTI

The ac susceptibility of gadolinium was measured as a function of frequency and field from 200 to 295°K. The nature of the χ''–$\omega/2\pi$–T surface for GD was delineated in the vicinity of the Curie point from 33 to 200 Hz at fields less than 10 Oe. For the two samples in question, if there is a maximum in the losses, then from 232 to 290°K the maximum is found below 20 Hz, while below 232°K the maximum is found above 200 Hz. Measurable losses were found at all experimental frequencies at temperatures below the Curie point, which means that $\chi_0 \neq \chi'$ above 20 Hz. A thermal hysteresis effect was observed in both components of the ac susceptibility near the Curie point at all experimental frequencies and fields. A field at which both χ' and χ'' are maximum was found to occur between 8 and 25 Oe for Gd–I as the sample was cooled below 232°K. Author (NSA)

N69-27213# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STRUCTURE OF LIGHT BEAMS REFLECTED BY THE LEAVES OF VEGETATION
V. P. Rvachev 2 Jul. 1968 15 p refs Transl. into ENGLISH from Zh. Prik. Spektroskopii (USSR), v. 4, no. 5, 1966 p 415–421
(AD-683149; FTD-HT-23-369-68) Avail: CFSTI CSCL 20/6

Results are presented of a study on the structure of light flux reflected from leaves. The dependence of the brightness curves of its components on the wavelength and on the incidence angle of the beam in the spectral interval 400-1100 nm was investigated. Author (TAB)

N69-27223# Oak Ridge National Lab., Tenn.
TABLES OF THE FABRY FACTORS G AND V, AND OF MAGNETIC FIELD HOMOGENEITY, FOR THICK CYLINDRICAL COILS
Milan Wayne Garrett Feb. 1969 58 p
(Contract W-7405-eng-26)
(ORNL-4281) Avail: CFSTI

Tables are presented which describe the properties of cylindrical coils with two distributions of current density: A, uniform, and B (Bitter type), inversely proportional to the cylindrical radius. The insertion (A), identifies a statement or table description that does not apply to Bitter coils. In the first section, the Fabry power efficiency factor G is tabulated for some 3000 coils of each type and the square root (V^*) of the Fabry volume factor for 1000 coils, with the customary parameters α and β as arguments. The product GV^* is the field intensity F at the center of the coil (A). F is tabulated as a function of (α,β), and α as a function of (F,β)(A). There is also a table of 180 minimum volume coils (A), which have the lowest value of V^* that is consistent with a given value of G. In the second section, geometrical limits of field homogeneity, for a given percentage error, are defined in polar coordinates by a set of radii. The absolute error is defined as the magnitude of the vector difference of the local field and the field B_0 at the central origin. Author (NSA)

N69-27232 European Organization for Nuclear Research, Geneva (Switzerland).
CONTRIBUTIONS TO THE THEORY OF THE SYMMETRIC QUADRUPOLE TRIPLET
E. Regenstreif 1969 145 p refs
(CERN-69-2) Copyright. Avail: Issuing Activity

The matrix elements of the triplet are first written in a form suitable for analysis. Their variation is then considered in terms of the inter-lens drift length. Particular attention is given to the cases of degeneracy of the matrix elements. The important first-order optical characteristics of the triplet are next derived starting from the matrix elements given previously. The optical properties reveal the conditions under which one can obtain real images in both planes. The conditions leading to unit magnification and stigmatism are also investigated, and the impossibility of obtaining intrinsic stigmatism is pointed out. As a transition from the concept of a purely optical device and that of a beam transport element, angular and radial acceptances are considered and formulas for these characteristics are derived. The paramount characteristic of the triplet in connection with its beam transport properties, i.e., its phase acceptance, is examined and explicit formulas are established giving the phase acceptance either in terms of the matrix elements or directly in terms of the physical parameters of the triplet. The analytic form of the phase acceptance allows then a closer investigation and this study reveals a fundamental discrepancy between the two planes of the triplet: contrary to the focusing-defocusing-focusing plane where the phase acceptance steadily decreases when the inter-lens drift length goes from zero to infinity, conditions leading to a maximum of the phase-space acceptance in the defocusing-focusing-defocusing plane can be found. Author

N69-27287# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ACOUSTIC EMISSION FOR NONDESTRUCTIVE TESTING AND CERTIFICATION
M. W. Moyer 20 Feb. 1969 10 p Presented at Acoustic Emission Working Group Conf., New Orleans, 20 Feb. 1969
(Contract W-7405-ENG-26)
(Y-DA-2855; CONF-690205) Avail: CFSTI

The equipment employed in using acoustic emission testing as a tool for materials testing and certification is described. Tests performed on 8 aluminum alloys, an aluminum cantilever beam, and stress corrosion of uranium alloys are discussed. Future plans for the examination of welds and stress corrosion are given. Author (NSA)

N69-27293# California Univ., Berkeley. Dept. of Physics.
ANALYSIS OF RESISTIVITY MEASUREMENTS BY THE EDDY CURRENT DECAY METHOD
J. Lepage, A. Bernalte, and D. A. Lindholm Repr. from the Rev. of Sci. Instruments, v. 39, no. 7, Jul. 1968 p 1019–1026 refs
(Grant AF-AFOSR-290-63)
(AD-683889; AFOSR-69-0526-TR) Avail: CFSTI CSCL 20/3

A systematic analysis is presented of the conditions in which the measurements of resistivities of metallic samples by the eddy current decay method give meaningful and accurate results. Coil sample geometry and material parameters are examined by means of equivalent circuits, and ways of extracting the desired information from the signal are discussed. We report selected measurements on critical parameters. A carefully designed and tested apparatus for the accurate determination of resistivity at room and helium temperatures with an operational logarithmic amplifier has been constructed. Most of the important conclusions of this study are displayed in graphical form to assist workers in the field. Author (TAB)

N69-27320# California Univ., San Diego. Marine Physical Lab.
ABYSSAL HILL SLOPE DISTRIBUTIONS AND SONAR BEARING ERRORS
Michael S. Loughridge and F. N. Spiess 1 Nov. 1968 10 p refs
(Contract Nonr-260-103)
(AD-683326; MPL-U-18/68; SIO-REF-68-44) Avail: CFSTI CSCL 20/1

Ocean bottom slopes measured near 32 deg 40 min. N, 120 deg W with a deeply towed echo-sounder are used to obtain a cumulative distribution of bottom slopes and consequent transverse linear error in positions given by bottom-bounce sonar. It is indicated that 90% of the errors will be less than 1440 yards for north-south tracking azimuths, and less than 500 yards for east-west azimuths. Author (TAB)

N69-27331*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION AND CALIBRATION OF SOME ENERGY SOURCES FOR THE VISIBLE AND NEAR INFRARED REGIONS OF THE ELECTROMAGNETIC SPECTRUM
A. W. McCulloch, J. T. McLean, and E. I. Mohr (Columbia Union Coll.) May 1969 32 p Submitted for publication
(NASA-TM-X-63546; X-622-69-195) Avail: CFSTI CSCL 20F

Several small area energy sources useful as laboratory calibration sources were studied. These include the blackbody, the quartz-iodine lamp, the strip filament lamp, and a tungsten lamp. Although the blackbody is the ideal small area energy source, it was more convenient to use the tungsten strip filament, or the quartz-iodine lamps for small area sources. A method is described for evaluating total irradiance of the tungsten strip filament and quartz-iodine standards of spectral irradiance. The results are favorably compared to the accuracy of the Bureau of Standards. F.O.S.

N69-27340# Stanford Linear Accelerator Center, Calif.
FIELD EMISSION FROM A SUPERCONDUCTOR
A. Leger 1968 33 p refs Transl. into ENGLISH from J. Phys. Radium (Paris), v. 29, 1968 p 648–654
(SLAC-Trans-90) Avail: CFSTI

The current change is found to have a remarkable temperature dependence, it is not maximum at $T = 0$, and changes sign close to T_c. The emission current variation associated with the N–S phase transition at steady electric field is studied. The transition is modulated by applying an ac magnetic field and detecting synchronous ripples in the current. Although reproducibility is not good, the effect seems to exist. Author (NSA)

N69-27350# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRIC MOMENT OF A SPHERICAL PARTICLE TAKING INTO CONSIDERATION THE CONDUCTIVITY OF THE PARTICLE AND OF THE MEDIUM
A. V. Rastorgueva 5 Sep. 1968 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 9, no. 6, 1966 p 7–10
(AD-683163; FTD-HT-23-558-68) Avail: CFSTI CSCL 20/3

The electric moment is calculated for a spherical particle of known diameter. The moment is expressed as a function of the diameter, of electric field, and dielectric constants and conditions of both the particle and surrounding medium. The particular case of a particle in an a. c. field is studied in some detail, and the theoretical results agree with experiments in mineral separation. TAB

N69-27448# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
THEORY OF PHASE SEPARATION IN SOLID H SUB 3 SUB 2 MIXTURES
William J. Mullin and Harish K. Sarin [1969] 6 p refs Submitted for publication
(Contract N00014-67-A-0230)
(AD-682524) Avail: CFSTI CSCL 7/4

A theory based on a variational cluster expansion evaluation of the energy is applied to mixtures of solid hydrogen isotopes. We find a critical temperature TC = 4k in disagreement with the experiment value of 16k due to Kogan, Lazarev, and Bulatova. Author (TAB)

N69-27497# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DISCRETE METHOD OF PLATE AND SHELL CALCULATION
Yu. P. Petrov 6 Sep. 1968 27 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 10, 1967 p 53–69
(AD-683144; FTD-HT-23-672-68) Avail: CFSTI CSCL 20/11

By the term discrete method of plate and shell design is understood a numerical method which leads to a discrete solution, in particular the differential-difference method or the straight-line method. Earlier-developed discrete methods dealt with simple cases of plate and shell design. In this article it is shown that a discrete method can be generalized in a simple way for more complex problems in the mechanics of thin-walled structures (e.g., bending of a flexible plate, strength of an orthotropic, noncircular, cylindrical shell), and the final integro-differential equations obtained can be solved by successive approximations utilizing a discrete solution of a simple analogous problem as the zero approximation. TAB

N69-27534## Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
BROADBAND ELECTROMAGNETIC TESTING METHODS. PART 4: MULTIPARAMETER TEST PRINCIPLES
H. L. Libby 1 Jan. 1969 60 p refs
(Contract AT(45-1)-1830)
(BNWL-953-Pt-4) Avail: CFSTI

Multiparameter or multivariable eddy current principles and techniques are described whose application gives more information about test specimens than can be obtained using conventional eddy current nondestructive test methods. The test coil assembly is driven by multifrequency or pulsed currents. Its output, having been modulated by the test parameters or variables is amplified, applied to spectrum filters and demodulated. The demodulated signal components are then recombined in selected linear combinations to give the read-out of individual test parameters or separate output channels. The principles are explained by a generalization of the single frequency phase discrimination technique, by an algebraic method and by a geometrical interpretation involving vector spaces. Selected test results are given for two and four frequency test systems. Author (NSA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-28184# Weapons Research Establishment, Salisbury (Australia).
DETAILED INVESTIGATION OF THE SHOCK WAVE PRODUCED BY THE RELEASE OF NO_2 AT 110km ALTITUDE
K. H. Lloyd Dec. 1968 17 p refs
(TN-HSA-143) Avail: CFSTI

A quantitative analysis of the expanding halo, which was formed on the release of NO_2 at 110 km altitude, strongly indicates that the halo was due to small particles, or molecular clusters, rather than due to a shock wave. Author

N69-28186 Cornell Univ., Ithaca, N.Y.
THEORETICAL STUDIES IN VIBRATIONAL RAMAN INTENSITIES
Jane Jeng Jeng Tang (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-16766

The Kramers–Heisenberg dispersion theory is expressed in terms of a sum over all excited states, while the bond polarizability theory is expressed in terms of the derivative of the polarizability tensor. The object is to try to bring together the Kramers–Heisenberg dispersion theory and the bond polarizability theory. A new approach is presented which is cast into a ground state formalism. Starting with the Kramers–Heisenberg dispersion theory as a basis, the sum over excited states is transformed into an infinite series in ground state matrix elements involving an average energy. Particular choice of this average energy and neglect of all terms $N \geq 2$ amount to the same approximations as in a variation-perturbation approach used by others. This truncated series, after a transformation through a quantum mechanical identity, assumes a particularly simple form. Calculations using this simple expression are presented for both the H_2^+ ion and the H_2 molecule for several approximate wavefunctions. Dissert. Abstr.

N69-26246*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.
STUDY OF VIBRATIONAL EXCITATION MECHANISMS OF CO_2 AT HIGH TEMPERATURES
Joseph W. Rich, Ronald G. Rehm, and Charles E. Treanor 31 Oct. 1968 88 p refs
(Contract NAS2-4185)
(NASA-CR-73325; CAL-AM-2438-A-1) Avail: CFSTI CSCL 20H

The results of calculations for the vibrational excitation of CO_2, in an approximate normal mode model, are reported. In these calculations, the intermolecular potential is not spherically symmetric, allowing investigation of the effects of potential anisotropy and participation of the rotational energy mode. It is found that the rotational mode can make a contribution to vibrational excitation over a considerable range of relative translational energies in the collision. The degree of participation of the rotational mode is a strong function of the potential anisotropy. A discussion is given of a Monte Carlo scheme for obtaining thermally-averaged cross sections for vibrational excitation. The scheme utilizes the variance reducing technique of importance sampling, together with a property of averaging integrals, to calculate the integrals for several temperatures efficiently. Completely analytical studies of greatly simplified models of the collision process also are reported. In particular, an approximate model of potential anisotropy and rotational effects is given. An analytical form for the vibrational energy gained by the vibrational mode during collision is obtained. Author

N69-26279# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON NONEQUILIBRIUM RADIATION BY A STRONG SHOCKWAVE
A. D. Nadezhin et al 1969 7 p refs Transl. into ENGLISH from Prikl. Mat. i Teknn. Fiz. (USSR), no. 1, 1969 p 27–32
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Nonequilibrium radiation from the first negative band of the nitrogen N_2^+ molecular ion is examined. Various excitation mechanisms of the N_2^+ ion are discussed; the formula for the cross section of molecular nitrogen ion excitation by an electronic shock is derived, and the radiation intensity in electronic bands of molecules is calculated. Excitation of the molecular nitrogen ion by a vibrationally excited nitrogen molecule is the predominant mechanism at a 6 km/sec shock velocity. At a 8 km/sec shockwave velocity in air, however, the fundamental excitation mechanism is electronic impact. The difference is due to the significant increase in electron concentration at the higher shock velocity. P.A.B.

N69-26320# Stanford Univ., Calif. High Energy Physics Lab.
EXPERIMENTAL DETERMINATION OF THE TRANSITION EFFECT IN ELECTROMAGNETIC CASCADE SHOWERS
Randy R. Whitney, Carol Jo Crannell, Hall Crannell, C. Richard Gillespie, and Klaus Pinkau Nov. 1968 27 p refs Prepared in cooperation with Catholic Univ.
(Contract Nonr-225(67))
(AD-683705; HEPL-587) Avail: CFSTI CSCL 18/4

The transition effect, occurring when an electromagnetic cascade crosses the boundary between different materials, has been measured. This transition effect is a rapid change in the numbers and spectra of electrons and photons which constitute the cascade and in the resultant energy deposition. The magnitude of this effect depends on the age of the shower at the discontinuity in the critical energies. Author (TAB)

N69-26363 Pittsburgh Univ., Pa.
QUANTITATIVE INTERPRETATION OF ULTRAVIOLET FLOW DICHROISM
John Eric Mayfield (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-16625

The technique of ultraviolet flow dichroism of rod shaped molecules was examined both theoretically and experimentally in the hope of finding ways to make interpretation of results more quantitative. Experiments showed that spectra for TMV and for bacteriophage fd are no more than slightly influenced by the index of refraction of the solvent and that, therefore, form dichroism does not contribute significantly in these systems. An approximate theory was developed which relates the anisotropic light scattering to the dichroism of a partially oriented solution of rods. This theory allows light scattering to serve as a measure of particle orientation. The procedure is demonstrated for TMV and the experimental results very closely fit the curves predicted by the theory, suggesting that the technique is capable of considerable accuracy. Dissert. Abstr.

N69-26378# Commissariat à l'Energie Atomique, Bruyeres-le-Chatel (France).
CONTRIBUTION TO THE STUDY OF THE REACTION $p + {}^{11}B = 3\ \alpha$ BY THE COINCIDENCE METHOD [CONTRIBUTION A L'ETUDE DE LA REACTION $p + {}^{11}B = 3\alpha$ PAR LA METHODE DES COINCIDENCES]
Jean-Philippe Laugier (Ph.D. Thesis—Paris Univ., Orsay, France, 16 Oct. 1968) Feb. 1969 117 p refs In FRENCH; ENGLISH summary
(CEA-R-3870) Avail: CFSTI

The production mode of the 3 α system in the reaction $p + {}^{11}B = {}^{12}C^* = \alpha + {}^8Be^*$; ${}^8Be^* = \alpha + \alpha$ has been studied and it was found that : (a) the influence of the ^8Be residual nucleus states = sequential decay ; (b) the influence of the ^{12}C compound nucleus states = spin effect; (c) an interference effect exists. Theoretical expressions for the different spectra which account for the observed phenomena are given. The phase shift between the waves associated with the detected particles, which produces the interference effects was taken as a parameter. The main characteristics of the experimental devices were: (a) self supporting boron targets; (b) cooled semiconductor detectors; (c) multiparametric systems so that for each nuclear event the energies of the detected particles and the time of the detection were recorded as parameters; (d) recording system: the information was recorded on a magnetic tape and at the same time treated with an on-line CAE 510 computer. Author (ESRO)

N69-26380 Johns Hopkins Univ., Baltimore, Md.
ON THE CALCULATIONS OF OPEN-SHELL ELECTRON CORRELATION EFFECTS AND ENERGY CALCULATION BY THE METHOD OF LOCAL MOMENTS
Moon-Lung Yin (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-16503

Three methods for calculating both pair correlations and specifically open-shell correlations separately were discussed. These methods are: (1) using a known accurate wave-function; (2) variational method; and (3) modified perturbation method. Using accurate wavefunctions for $2\,^1P$ and $2\,^3P$ states of helium, it was found that the dynamical, transferable pair correlation energies account for 90% of the total correlation energies, the open-shell correlation effects account for half the remaining. By using the variational method the polarization and semi-internal correlation energies for $2\,^3P$ helium were computed separately from the pair correlation energies to about 96% accuracy. The polarization and semi-internal correlation energies corresponding to $1s^22s^22p^n \rightarrow 1s^22ss'2p^n$ for B, C, N, O and F atoms at their ground states were also computed variationally and found to be in au (1 au ≅ 27.2 eV) −0.00050, −0.00204, −0.00434, −0.00205 and −0.00077 respectively. Dissert. Abstr.

N69-26387# New York Univ., N.Y. Dept. of Physics.
THE QUANTUM MECHANICAL MANY-BODY PROBLEM
Final Report, 1 Feb. 1964–30 Nov. 1968
A. E. Glassgold 14 Feb. 1969 5 p refs
(Grants DA-ARO(D)-31-124-G523; DA-ARO(D)-31-124-G666)
(AD-683602; AROD-4614.14-P) Avail: CFSTI CSCL 20/10

A wide variety of quantum mechanical many-body problems were investigated. The two significant accomplishments of this research are as follows: The development of DCF (dynamical characteristic function) method for treating the statistical mechanics of quantized fields, and the general treatment of the condensate of liquid helium for the case of uniform thermodynamic equilibrium. Author (TAB)

N69-26389# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO THE STUDY OF AXIAL INJECTION OF POLARIZED PROTONS INTO THE GRENOBLE CYCLOTRON [CONTRIBUTION A L'ETUDE DE L'INJECTION AXIALE POUR PROTONS POLARISES SUR LE CYCLOTRON DE GRENOBLE]
Jean-Louis Pabot (Ph.D. Thesis—Grenoble Univ., 7 Aug. 1968) Feb. 1969 98 p refs In FRENCH; ENGLISH summary
(CEA-R-3729) Avail: CFSTI

By injecting ions axially into a cyclotron, it is possible to accelerate particles (polarized particles, heavy ions, etc...) obtainable only with difficulty when an internal ion source is used. In this work, after justifying the choice of an axial injection device equipped with a 'pseudo-cylindrical' deflector for the Grenoble cyclotron, the principle of such a detector, the choice of its parameters, and the effect of this choice on the conditions of acceleration of the beam by the cyclotron are studied theoretically. This report also describes two operations which made it possible to check that the chosen injection device operated satisfactorily, qualitatively initially (electron model), then quantitatively (proton model). It is believed that the Grenoble cyclotron thus equipped will be able to provide a relatively dense beam of polarized protons. Author (ESRO)

N69-26390# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
IRRADIATION DAMAGE: DISPLACEMENT ZONE [DOMMAGES SOUS IRRADIATION: ZONE DE DEPLACEMENTS]
Jean-Pierre Genthon (Ph.D. Thesis—Paris Univ., Orsay, France, 5 Jul. 1967) Jan. 1969 133 p refs In FRENCH; ENGLISH summary
(CEA-R-3712) Avail: CFSTI

A charged particle (ion, primary atom, etc...) moving in a solid slows down and can cause a cascade of displacements of the atoms in the solid. This report concerns the extent to which the cascade, as a function of the energy of the initial charged particle, is or is not, made up of independent collisions. When the distance between the collision is small, these latter are no longer independent; the cascade, which then has to be considered as a whole, perturbs and locates, in the irradiated solid, a zone which has been named a 'displacement zone'. It is shown that the proportion of displacement zones increases with increasing atom size (high atomic number Z), with decreasing atomic distance D in the substance considered, and with decreasing energy of the ion undergoing the slowing down process (although always remaining above a few hundred eV). The proportions obtained are higher than those corresponding to the calculations of J. A. Brinkmann. An interatomic potential required for this work has also been determined. Author (ESRO)

N69-26415# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
STUDY OF HETEROGENEOUS MULTIPLYING AND NON-MULTIPLYING MEDIA BY THE PULSED NEUTRON TECHNIQUE [ETUDE DES MILIEUX HETEROGENES MULTIPLICATEURS ET NON-MULTIPLICATEURS PAR LA TECHNIQUE DE LA SOURCE PULSEE DE NEUTRONS]
Valentine Deniz (Ph.D. Thesis—Paris Univ., Orsay, France, 24 Jun. 1968) Feb. 1969 194 p refs In FRENCH; ENGLISH summary
(CEA-R-3640) Avail: CFSTI

The pulsed neutron technique consists essentially in sending to the medium to be studied a short neutron pulse and in determining the asymptotic decay constant of the generated population. The variation of the decay constant as a function of the size of the medium allows the medium characteristics to be defined. This technique has been largely developed in recent years and has been applied as well to moderator as to multiplying media – in most cases homogeneous ones. It was considered of interest to apply this technique to lattices, to see if useful information could be collected for lattice calculation. A general theoretical study of the problem is presented and results and interpretation of a series of experiments made on graphite lattices. There is a good agreement for non-multiplying media. In the case of multiplying media, it is shown that the age value used until now in graphite lattices calculations is overestimated by about 10 per cent. Author (ESRO)

N69-26418*# College of William and Mary, Williamsburg, Va.
THE 3d–2p PIONIC TRANSITION IN Ni 58 AND Ni 60
D. A. Jenkins (Va. Polytech. Inst.), R. J. Powers (Va. Polytech. Inst.) and G. H. Miller [1968] 30 p refs
(Grant NGL-47-006-008)
(NASA-CR-101120) Avail: CFSTI CSCL 20H

The 3d–2p pionic X-rays in Ni^{58} and Ni^{60} were observed in order to measure the strong interaction between the pion and the nucleus. These isotopes were chosen because nuclear effects in the X-ray energy are expected to be large and the X-ray yield is appreciable. A large nuclear level shift and broadening, but no isotope effect within experimental error was observed. The strength of the pion–nuclear interaction is found to have a strong dependence on the neutron radius, and results are consistent with the hypothesis of equal neutron and proton rms radii. Uncertainties in the pion–nuclear interaction do not allow an accurate determination of the neutron radius. Author

N69-26453# Rome Univ. (Italy). Inst. of Physics.
SINGLE NEGATIVE PION PHOTOPRODUCTION ON DEUTERIUM IN THE ENERGY RANGE 500-800 MeV: PRELIMINARY INVESTIGATION
M. Beneventano, F. de Notaristefani, P. Monacelli, L. Paoluzi, F. Sebastiani et al 20 Nov. 1968 17 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna 182 bis
Avail: CFSTI

Abeolute differential cross sections for the photoproduction of negative pions on deuterium have been measured at the 1.1 GeV Frascati electron synchroton for photon energies K between 500 and 800 MeV and for π^- C.M. angle of $\theta = 90°$. Author (ESRO)

N69-26459# Aktiebolaget Atomenergi, Studsvik (Sweden).
ON LOW ENERGY LEVELS IN ^{185}W
Sven G. Malmskog, Mats Höjeberg (Stockholm Univ.), and Valter Berg (Stockholm Univ.) Feb. 1969 19 p refs Submitted for publication
(AE-349) Avail: CFSTI

Gamma ray spectra in the decay of ^{185}Ta and ^{185m}W have been studied with Ge (Li) detectors. The ^{185m}W isomeric transition at 131.6 keV is shown to be of E3 multipolarity. A level scheme of ^{185}W is proposed with the following energy levels (energies in keV, spin and K quantum numbers in parentheses): 0 (3/2$^-$ 3/2), 23.5 (1/2$^-$ 1/2), 65.9 (5/2$^-$ 3/2), 93.5 (3/2$^-$ 1/2) (uncertain), 173.9 (7/2$^-$ 3/2), 188.1 (5/2$^-$1/2), 197.5 (11-2$^+$ 11/2), 243.5 (7/2$^-$ 7/2), and 390.8 (9/2$^-$ 7/2). Author (ESRO)

N69-26461# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
MEASUREMENTS OF CATHODE HEATING IN A PENNING DISCHARGE IN A STRONGLY INHOMOGENEOUS MAGNETIC MIRROR FIELD
N. Hopfgarten Feb. 1969 42 p refs
(Rept-69-01) Avail: CFSTI

Ions and electrons bombarding the cathodes in a Penning discharge in a magnetic mirror field heat the cathodes and release secondary electrons. From measurements of cathode heating, currents, and burning voltages it is possible to estimate the density and energy of ions leaving the discharge to the cathodes, as well as the currents of electrons arriving at the cathodes and the currents of electrons leaving them. Mean ion densities in the range 10^{10} - 10^{11} cm^{-3} and mean ion energies between 1 and 5.5 keV are obtained. The discharge is burning with one cathode on a high voltage and the other on a low voltage, that is the discharge is burning unsymmetrically. 60-70% of the current to the high voltage cathode is carried by ions. The current of electrons to the low voltage cathode is about 30-50% of the ion current. The current of electrons leaving this cathode depends strongly on the degree of unsymmetry of the discharge. Author (ESRO)

N69-26494 Washington Univ., Seattle.
THEORY OF THE LOW EXCITED STATES OF NORMAL LIQUID HELIUM THREE
Hing-Tat Tan (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17211

Recently the application of the correlated basis function method to the ground states of He^3, He^3-He^4 mixture and solid He^3 was very successful. This thesis is concerned with the low excited states of normal liquid He^3. It presents a way of extracting the single particle energy ϵ_k of quasi particle k and interaction energy $f_{p,q}$ between particle p and q of Landau theory from first principles. Our many particle wave function has the form $\Psi = \Psi^B_0 \phi$. Here Ψ^B_0 is the mass three boson type ground state wave function satisfying $H\Psi^B_0 = E^B_0\Psi^B_0$ where H is the Hamiltonian of the He^3 system and ϕ is a slater determinant of plane waves and spin functions. The potential function is the 6-12 Lennard Jones potential with the parameters determined by de Boer and Michels. Thus Ψ^B_0 takes care of the strong repulsion which occurs as particles get very close to each other and ϕ provides the proper symmetry. Dissert. Abstr.

N69-26496 Washington Univ., Seattle.
NUCLEAR SPIN-PHONON INTERACTIONS AND MAGNETOELASTIC COUPLING IN THE CUBIC ANTIFERROMAGNET RbMnF$_3$
Robert Lee Melcher (Ph.D. Thesis) 1968 226 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-17196

The resonant coupling between coherent radio frequency acoustic phonons and the F^{19} nuclear spin system in the antiferromagnetically ordered state of $RbMnF_3$ was investigated experimentally. Both the nuclear acoustic resonance (NAR) dispersion and absorption modes were observed using an ultrasonic transmission spectrometer developed for this study. Transverse and longitudinal ultrasonic waves were propagated along the [100] and [110] axes of the cubic system and the dependence of the nuclear spin-phonon coupling strength on the orientation of the applied magnetic field was determined. A phenomenological nuclear spin-phonon interaction involving two coupling constants is proposed. The orientation dependence of the coupling strength is adequately described by this interaction. The NAR absorption lineshape is quite complex and not fully understood at this time. Dissert. Abstr.

N69-26551# Utah State Univ., Logan. Electro-Dynamics Labs.
A MEASUREMENT AND ANALYSIS OF OPTICAL EMISSIONS RESULTING FROM 20 TO 100 KeV PROTON-NITROGEN COLLISIONS
Harold A. B. Gardiner 1 May 1968 56 p refs
(Contract AF 19(628)-5916)
(AD-683795; AFCRL-68-0287; SR-4) Avail: CFSTI CSCL 4/1

Absolute cross sections for excitation of the N2(+) first negative bands in collisions of 20- to 100-keV protons with N2 have been measured under single conditions. On the basis of a charge-exchange model which predicted the observed variation of intensity with pressure, emission cross sections for the (0,0) 3914 A N2(+) first negative band and the (0,2) 3805 A N2 second positive band were obtained for hydrogen atom impact and the sum of the cross sections for electron capture and loss were found for hydrogenic particles traversing N2. An upper limit of 4 x 10 to the -20th power sq cm has been established for the cross section for 100 keV proton impact excitation of the second positive band. A critical analysis shows that the intensity-versus-pressure curve for this band provides a sensitive means of detecting secondary processes in this beam experiment. Cross sections for production of H sub beta radiation, determined from observations made at a point 30.5 cm from the collision chamber entrance, were found to be more than a factor of three larger than those reported by previous investigators. The cross section for collisional quenching of a 100-keV hydrogen atom from the n=4 level was estimated as 3 x 10 to the -16th power sq cm. Author (TAB)

N69-26569# Rochester Univ., N.Y. Nuclear Structure Research Lab.
LEVELS IN Pb 207 FROM THE Pb 208 (He 3, α) Pb 207 REACTIONS AT 28 MeV
W. P. Alford and D. G. Burke (McMaster Univ., Hamilton (Ontario)) Apr. 1969 20 p refs Sponsored jointly by NSF, and Natl. Res. Council of Can.
(UR-NSRL-19) Avail: Issuing Activity

Alpha particles leading to states below 4.4 MeV excitation were observed in the $Pb^{208}(He,\alpha)Pb^{207}$ reaction at 28 MeV. Angular distributions have been measured for strong groups leading to the known single-neutron hole states. The DWBA calculations show good agreement with the shapes of the measured angular distributions, and yield relative spectroscopic factors close to those predicted by the simple shell model, except for the $h_{9/2}$ state at 3.43 MeV. Sixteen other weakly-excited states are observed above an energy of 2.6 MeV. Most of these are apparently not observed in other reactions leading to Pb^{207} excited states. Author

N69-26584 Cornell Univ., Ithaca, N.Y.
HYDRODYNAMIC THEORY OF EXCITATIONS IN SUPERFLUID HELIUM
Allan Widom (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-16203

A hydrodynamic theory of excitations in superfluid helium is proposed. The resulting excitation spectra are related to the true energy spectrum by rigorous inequalities. Numerical calculations are based on neutron scattering data and on the Dalgarno-Lewis variational method. The conclusion of the numerical work is that the proposed theory produces an excitation spectrum which is at least as accurate as the Feynman–Cohen spectrum. The analogous form for the spectrum of He^3 impurities is rigorously exact. This follows from a new effective mass sum rule which is the impurity analogue of the well known compressibility sum rule for pure liquid He^4. Dissert. Abstr.

N69-26588# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
THE PRODUCT STRUCTURE OF MEASUREMENTS
Donald A. Jacobson Dec. 1968 32 p refs *Its* Res. Commun. No. 88
(AD-683566) Avail: Issuing Activity CSCL 20/8

In particle momentum measurements, loosely speaking, the result of a multiparticle measurement is the direct product of the result of several single-particle measurements. This built-in product structure for particle momentum measurements forms the basis for a simple presentation of the decomposition principle or cluster structure of the S-matrix. In a previous paper we began the formulation of an S-matrix theory valid for arbitrary measurements. To introduce the decomposition principle into this theory, it is first necessary to investigate the product structure of arbitrary measurements. In the present paper, the fundamental properties of such a product structure are derived from a postulate describing the way two states can be combined to form a single compound state. Author (TAB)

N69-26614# Rome Univ. (Italy). Inst. of Physics.
MEASUREMENTS OF PION ELECTROPRODUCTION CROSS SECTION NEAR THRESHOLD
E. Amaldi, B. Borgia, P. Pistilli, M. Balla (Pisa Univ.), G. V. DiGiorgio (Pisa Univ.) et al 27 Nov. 1968 13 p refs Submitted for publication Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna 194
Avail: CFSTI

Some preliminary results obtained from a partial analysis of the data collected from a coincidence experiment on the electroproduction of pions near threshold are discussed. In its complete form the experiment aims at isolating the cross section of the reactions yielding positive pions by observing those inelastically scattered electrons which are not accompanied by the emission of one proton or in which wide angle bremsstrahlung is emitted, instead of a pion. ESRO

N69-26628 Stevens Inst. of Tech., Hoboken, N.J.
VACUUM FLUCTUATIONS AND SELF-ENERGIES IN QUANTUM ELECTRODYNAMICS
Herbert Tesser (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-16228

The methods of Kramers are applied to a modified version of the electrodynamics of Schoenberg, Rohrlich and Bergmann, yielding an electrodynamics free of mass renormalization. The Lorentz-Kramers' equations of motion for a first quantized particle interacting with a second quantized electromagnetic field are solved in the dipole approximation. For the free particle, the harmonic oscillator, and the particle in a uniform magnetic field, finite energies are obtained which are in agreement with the results of comparable renormalized theories. The role of charge fluctuations and Zitterbewegung in determining the response of a charged particle to the electromagnetic field is also investigated. It is shown that the Zitterbewegung and charge fluctuations introduce convergence at the Compton wavelength for the Lamb shift and anomalous magnetic moment of the electron. Dissert. Abstr.

N69-26631# Gulf General Atomic, San Diego, Calif.
IMPROVED FREVAP (-9) CODE FOR CALCULATING THE RELEASE OF METALLIC FISSION PRODUCTS FROM HTGR FUEL CORES
L. R. Zumwalt 1 Aug. 1968 6 p refs
(Contract AT(04-3)-633)
(GAMD-8813) Avail: CFSTI

The FREVAP–8 code for estimating the release of fission products from HTGR fuel elements and entire cores assumes that a steady-state is attained in the transport of fission products through the graphite of the fuel element. Experimental studies indicate there is a fast transport process at early times and that the transport of metallic fission products can be far from the steady-state condition at a given time and temperature. A mathematical formulation for FREVAP-9 which is designed to account for these effects is described. NSA

N69-26635# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
IONIZATION OF POLARIZED DEUTERONS IN A CYCLOTRON BY AN INTENSE ARC SOURCE [IONISATION DE DEUTONS POLARISES DANS UN CYCLOTRON PAR UNE SOURCE A ARC DE GRANDE INTENSITE]
R. Mailliard and A. Papineau [1968] 3 p refs In FRENCH; ENGLISH summary Presented at the Conf. on Exptl. Methods in Nucl. and Particle Phys., Strasbourg, 4 Dec. 1968
(CEA-CONF-1227; CONF-681208-4) Avail: AEC Depository Libraries

With a large-cathode ionization source the beam of polarized deuterons now has an intensity of 5 nA. Under these conditions, the yield of polarization is estimated at 50% Author (NSA)

N69-26639# Stanford Linear Accelerator Center, Calif.
THE MESOTRON: AN ELECTRON ACCELERATOR FOR HIGH FINAL ENERGIES
G. Bathow, E. Freytag, and H. O. Wuester [1968] 24 p refs Transl. into ENGLISH from German Rept. DESY-68/58
(SLAC-Trans-89; DESY-68/58) Avail: CFSTI

The circular electron accelerator described is characterized by the following properties: the energy gain per turn is an appreciable fraction of the final energy; thus the electrons perform only a small number of turns, electrons in different turns are simultaneously accelerated in linear accelerator structures, and electrons of different energies are focussed on separated orbits; thus

dc–powered magnets may be used in the circular sections. Comparison of the proposed accelerator with the conventional synchrotron and the linear accelerator is made and the possible advantages are discussed. The use of superconducting acceleration structures would allow a duty-cycle of 100%. In this case the proposed accelerator is expected to have economical advantages compared to a superconducting linear accelerator of the same duty-cycle for energies up to approx. 60 GeV. The possible application for proton acceleration is pointed out. Author (NSA)

N69-26641# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ROTATIONAL RELAXATION IN NONPOLAR DIATOMIC GASES
John A. Lordi and Robert E. Mates May 1969 67 p refs
(CAL-170) Avail: Issuing Activity

The rotational–translational energy transfer in collisions between homonuclear diatomic molecules and the rotational relaxation time in diatomic gases were investigated classically. Numerical solutions were obtained for the rotational energy transfer in individual collisions. Results are presented for the shear viscosity, thermal conductivity, and rotational relaxation time in N_2 which compare favorably with experimental values. An approximate solution for the rotational energy transfer in coplanar collisions was obtained for arbitrary initial values of the collision parameters. The rotational relaxation time was also evaluated and found to agree very well with the Monte Carlo calculation over a range of temperatures. The effect of unequal rotational and translational temperatures was found to be significant. The approximate results for the relaxation time are compared with experimental data for N_2 and O_2, obtained using a variety of techniques, including ultrasonic, shock-wave, and free-jet experiments. The agreement with experiment is very good, particularly with ultrasonic data over a wide temperature range for N_2 and O_2. Author

N69-26644# Electronic Specialty Co., Portland, Oreg. Electronics Div.
PARTIAL EXCITATION IN WAVE MECHANICS
James W. Deer 23 Dec. 1968 26 p refs
(AD-683388) Avail: Issuing Activity CSCL 20/8

By reinterpreting expectation value as effective value, a wave mechanics is obtained which contains spontaneous emission explicitly. This implies a nonquantized electromagnetic field, and allows the bound electron to take on a continuous range of energy values. Radiation reaction force then occurs on absorbtion, but not on emission. It is argued that present experimental evidence does not exclude this possibility. An experiment is given for making a positive test of the predicted phenomenon. This involves a beam of sodium atoms, deflected by means of illumination from the side by a sodium lamp. The beam of atoms is collected on a flat surface for analysis of the distribution pattern. Nominal deflection angle is 3 x 10 to the minus 5th power radians. Author (TAB)

N69-26649# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
RAPID PULSATION OF AN ACCELERATOR BEAM BY MEANS OF A DEFLECTION BY A PROGRESSIVE WAVE [PULSATION RAPIDE D'UN FAISCEAU D'ACCELERATEUR AU MOYEN D'UNE DEFLEXION A ONDE PROGRESSIVE]
Michel Roche [1968] 7 p In FRENCH; ENGLISH summary Presented at the Conf. on Exptl. Methods in Nucl. and Particle Phys., Strasbourg, 4 Dec. 1968
(CEA-CONF-1202; CONF-681208-7) Avail: CFSTI

A low energy ion beam modulating device is used in an accelerator to create a pulsed neutron flux. The neutron flux is produced by interaction of the ion beam with a neutron generating target. The ion beam is deflected by a succession of short plates (2 cm). These plates, regularly spaced along the axis, are joined together by pieces of 100 Ω coaxial cable, the length of which are adjusted in such a way that the travelling wave axial velocity (i.e., the velocity of the wave measured between 2 plates) is the same as that of the beam particles. This system allowed the modulation of a deuteron beam in the energy range 150–400 kev in rectangular impulsions with rise times of less than 1.5×10^{-9} sec. By using a particle regrouping device in conjunction with the apparatus, neutron impulses of less than 10^{-9} sec were obtained. Author (NSA)

N69-26650# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SOURCES OF PHOTONS OBTAINED FROM POSITRON ANNIHILATION IN FLIGHT [SOURCES DE PHOTONS OBTENUS PAR ANNIHILATION EN VOL DE POSITONS]
G. Audit, N. De Botton, G. Le Poittevin, C. Schuhl, and G. Tamas [1968] 6 p refs In FRENCH; ENGLISH summary Presented at the Conf. on Exptl. Methods in Nucl. and Particle Phys., Strasbourg, 4 Dec. 1968
(CEA-CONF-1225; CONF-681208-3) Avail: AEC Depository Libraries

A calculation of the spectrum of photons obtained from positron annihilation in flight is presented. Multiple scattering and energy loss of positrons in the annihilation target are accounted for. Results are presented in the range 150–450 MeV (Saclay Linac) and compared with measurements at low energy. Author (NSA)

N69-26655# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
UNIFIED FIELD THEORY
Dave Pandres, Jr. Nov. 1968 28 p refs *Its* Res. Commun. No. 80
(AD-683558) Avail: Issuing Activity CSCL 20/10

A solution is given to the problem of constructing a unified theory of the gravitational and electromagnetic fields. The theory exhibits the following features: (1) It is fully geometrical, the geometry being a special type of four-dimensional Riemannian space-time. (2) It is completely unified, all physical features (i.e., of curvature) being introduced via a quantity which transforms irreducibly under the coordinate transformations of general relativity. (3) The gravitational field and the electromagnetic field are inextricably linked, each being merely a different manifestation of the geometrical structure. (4) Charged particles move according to the Lorentz force law. (5) The energy density is everywhere nonnegative. (6) The field equations insure that the electrical current density is everywhere timelike and that charged particles have extended structures rather than point structures. Author (TAB)

N69-26663*# Ohio State Univ., Columbus. ElectroScience Lab.
FORMATION OF IONIZED EXCITED STATES FROM THE LOSS OF THE METASTABLE ELECTRON IN THE NOBLE GAS ATOMS
S. H. Koozekanani 19 Apr. 1968 13 p refs
(Grant NsG-74-60)
(NASA-CR-101088; TR-1093-39) Avail: CFSTI CSCL 20H

It is shown that when the metastable electron of a noble gas atom is removed by a fast collision it is quite possible for the atom to be ionized and excited at the same time. Excitation cross sections for the processes $np^5 - (n+1)s^3np^4 - m\ell''$ or $np^5 - (n+1)s^2np^4 - m\ell''$ have been calculated in terms of the cross sections for removing the electrons. Author

N69-26679# Aktiebolaget Atomenergi, Stockholm (Sweden).
A DETERMINATION OF THE 2200 m/s ABSORPTION CROSS SECTION AND RESONANCE INTEGRAL OF ARSENIC BY PILE OSCILLATOR TECHNIQUE
E. K. Sokolowski and R. Bladh Feb. 1969 15 p refs
(AE-351) Avail: CFSTI

Pile oscillator measurements of heavy-water solutions of As, B, Mn and In have been carried out in two different neutron spectra in the RO reactor. For B, Mn and in the 2200 m/s cross section values recommended in previous work are given to within 1.5% or less while for As the stated uncertainty is 5%. In the present work these values for B, Mn and In were used to derive weighted mean calibration constants for the reactor, which were then in turn used for obtaining self-consistent cross section values for all four elements. The values thus obtained for B, Mn and In were within experimental error of the recommended values. The absorption cross section for As is in good agreement with a recently published value for the activation cross section. The value for the resonance integral of As, derived from the present measurements, is in better agreement with calculations from resonance parameters than values reported earlier. Author (ESRO)

N69-26692 Kansas State Univ., Manhattan.
THE INFRARED ABSORPTANCE OF CARBON MONOXIDE AND NITROUS OXIDE AT REDUCED TEMPERATURES
Gary McClellan Hoover 1968 207 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-17509

This thesis consists of two parts: (1) a study of CO absorption line strengths and half-widths at reduced temperatures and (2) a study of the band absorptance of the CO fundamental and two N_2O fundamental bands over a wide temperature range. The apparatus and experimental techniques used in the measurement of the equivalent widths of rotational lines in the CO fundamental are described. The equivalent widths of lines R(0) – R(15) were measured for conditions corresponding to both the linear region and the square-root region for gas temperatures of 300°K, 193°K, 153°K, and 113°K. Measurements in the linear region were used to determine absorption line strengths and the data in the square-root region was used to determine the half-widths of the self-broadened lines. The measured line strengths were in agreement with predictions based on the Herman–Wallis expression. Dissert. Abstr.

N69-26695# Los Alamos Scientific Lab., N.Mex.
LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Status Report, 12-Month Period Ending 31 Oct. 1968
15 Jan. 1969 121 p refs
(Contract W-7405-ENG-36)
(LA-4075-MS) Avail: CFSTI

The diagnoses of argon and deuterium plasmas in Z-pinch are reported. The developments in continuous flow pinch accelerators, plasma jets, switches, thermonuclear reactors, and plasma guns are included. NSA

N69-26699 Kansas State Univ., Manhattan.
EXPERIMENTAL DETERMINATION OF EXCITATION AND QUENCHING CROSS SECTIONS FOR THE MERCURY-THALLIUM SYSTEM
Billy Charles Hudson (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-17612

For a mixture of monatomic gases such as mercury and thallium, excitation energy can, under the proper conditions, be transferred by means of a collision process from atoms of one kind to another. The cross section for depopulating a particular state is called the quenching or de-excitation cross section for that state while the cross section for populating a particular state is referred to as the excitation cross section for that state. It was the purpose of this study to develop a method for determining the absolute value of this type of cross section and apply it to the mercury-thallium system. When a volume of mercury and thallium vapors is irradiated with 2537 Å mercury radiation, some mercury atoms absorb energy and are raised to the excited 6^3P_1 state. Dissert. Abstr.

N69-26711 Texas Univ., Austin.
CROSS SECTIONS FOR ASSOCIATIVE IONIZATION OF THE n = 3 STATES OF HELIUM
Charles Hudson Turner (Ph.D. Thesis) 1968 258 p
Avail: Univ. Microfilms: HC $11.70/Microfilm $3.35 Order No. 68-16150

The work describes a measurement of the cross sections for associative ionization of the n = 3 states of helium ($He^* + He \rightarrow He^+_2 + E$). The helium is excited in the positive column of a dc glow discharge yielding a distribution of excited states, ions, and electrons. The populations of the n = 3 excited states are varied selectively by photon absorption from the 2S and 2P states and monitored by optical spectroscopy. Through associative ionization there is a correlated variation in the concentration of molecular ions in the discharge. The ion current which effuses through a small hole in the wall of the discharge tube is focused by means of an ion lens onto the entrance aperture of a quadrupole mass filter which is adjusted to monitor the molecular ion current. The relation between the effusing ion current and the ion concentration in the discharge is given by the theory of the positive column. Dissert. Abstr.

N69-26712 California Univ., Los Angeles.
PION PRODUCTION IN PROTON-PROTON INTERACTIONS AT 6.6 GeV/c
Eugene Paul Colton (Ph.D. Thesis) 1968 213 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-16521

This dissertation is a study of proton-proton collisions resulting in reactions of the type proton + proton → nucleon + nucleon + mπ where m is an integer indicating the number of pions produced. In this work just the cases for m = 0, 1, 2, and 3 will be dealt with. The interactions were photographed in the Lawrence Radiation Laboratory's 72-inch liquid hydrogen bubble chamber which was exposed to a 6.6 GeV/c separated external proton beam. Two production topologies were analyzed. The two-prong events with no kinking, and the four-prong events. Dissert. Abstr.

N69-26715 California Univ., Los Angeles.
THE KAON PION INTERACTION IN POSITIVE KAON PROTON YIELDS KAON PION POSITIVE PION PROTON AT 7.3 GeV/c AND NEGATIVE CASCADE HYPERON PRODUCTION IN NEGATIVE KAON PROTON INTERACTIONS AT 2 GeV/c
Thomas Gordon Trippe (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16588

An analysis is presented on the Kπ interaction in the reactions $K^+p \rightarrow K^+\pi^-\pi^+p$ (1a), and $K^+p \rightarrow K^+\pi^0\pi^+p$ (1b). Some 3736 examples of reaction (1a) and 778 of (1b) were obtained from an exposure of the Brookhaven National Laboratory 80" bubble chamber to a beam of 7.3 GeV/c K^+ mesons. The π^+p scattering angular distributions obtained from reactions (1), assuming OPE (one-pion-exchange) are compared with real π^+p scattering data. Similarly obtained Kπ angular distributions are used to investigate Kπ scattering. Also studied are the reactions

$K^-p \rightarrow \xi^-K^+$, (2a), $K^-p \rightarrow \xi^-K^*\pi^+$, (2b), and $K^-p \rightarrow \xi^-K^+\pi^*$, (2c). The data were obtained from an exposure of the Lawrence Radiation Laboratory 72" bubble chamber to a beam of 2.0 GeV/c K^- mesons. Cross sections of 98.1 ± 5.9, 76.4 ± 4.6, and 36.2 ± 3.3 μb are obtained for reactions (2a), (2b), and (2c), respectively. Cross sections for $\xi^{*0}K^*$, $\xi^{*0}-K^+$, and ξ^-K^{*+} production of 55 ± 9.20 ± 5, and 21 ± 4 μb, respectively, are found. Dissert. Abstr.

N69-26716 Iowa Univ., Iowa City.
LIFETIME MEASUREMENTS IN THE P AND S–D SHELLS BY THE DOPPLER SHIFT ATTENUATION METHOD
Medville Jay Throop (Ph.D. Thesis) 1968 286 p
Avail: Univ. Microfilms: HC $13.50/Microfilm $3.70 Order No. 68-16866

The Doppler shift attenuation method was used to deduce lifetime information for electromagnetic transitions in B^{10}, B^{11}, B^{12}, B^{13}, C^{11}, C^{13}, C^{14}, N^{14}, N^{15}, N^{16}, N^{17}, O^{16}, O^{18}, F^{18}, Ne^{20}, and Ne^{21}, Ne^{22}, and Na^{22}. The combination of a Ge(Li) gamma ray detector and the use of lithium induced reactions permitted an accurate measurement of numerous lifetimes as well as the setting of improved limits for very fast lifetimes. In addition, a number of transition energies were measured with much improved accuracy. Dissert. Abstr.

N69-26752# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE EFFECT OF NONLOCAL CURRENTS ON THE NUCLEAR MAGNETIC DIPOLE MOMENTS
A. M. Korolev *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 355–361 refs (See N69-26751 14-23)
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The independent particle model was generalized by adding to the mean local potential a certain phenomenological nonlocal potential so that the magnetic dipole moment no longer fits the Schmidt line. Since the nonlocal potential can be written as a velocity dependent potential, nonlocal currents should arise in the nucleus, which interact with the external electromagnetic field and thus make an additional contribution to the nuclear magnetic moment. It is shown that these currents do not affect the probability of electrical multipole transitions, but the magnetic transitions are changed appreciably. The interaction Hamiltonian of a particle with the electromagnetic field is derived from the gauge invariance of the Lagrangian of a particle moving in a nonlocal potential. The deviation of the magnetic moments from the Schmidt lines is found to depend on two arbitrary parameters Λ and μ or on their combination and is determined by the state of the odd nucleon. B.P.

N69-26753# Israel Program for Scientific Translations, Ltd., Jerusalem.
MIXING IN THE 189- AND 405-PLETS OF THE SU(6) GROUP
L. Enkovski et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 362–369 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

It is assumed the mesons 2^+, 1^+, and 0^+ enter the 189- and 405-plets of the SU(6) group. It is also assumed that physical particles are states corresponding to multiplets of the subgroup SU (4) ⊗ SU (2), and not states of unitary multiplets. The form of the decomposition of the wave functions in the considered subgroup is then solved along with the isotopic and spin multiplets. Mixing formulas are derived for the 189- and 405-plets. Expressions for decay constants of physical particles are tabulated using these mixing relations and matrix elements. B.P.

N69-26754# Israel Program for Scientific Translations, Ltd., Jerusalem.
APPLICATION OF THE OPTICAL MODEL TO THE DESCRIPTION OF EFFECTS IN THE INTERIOR OF A NUCLEUS
V. D. Chesnokova *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 370–376 refs (See N69-26751 14-23)
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The fluxes and the divergence of the fluxes are calculated for 7 MeV neutrons in a lead-208 nucleus and for 5, 10, and 20 MeV neutrons in a calcium-40 nucleus using a nonlocal optical potential with surface absorption. Introduction of the nonlocal potential resulted in patterns of fluxes inside the nucleus for various neutron energies and in a determination of their variation with energy. Author

N69-26755# Israel Program for Scientific Translations, Ltd., Jerusalem.
ON THE MECHANISM OF PROTON POLARIZATION IN THE REACTION C 12 (d,p) C13 AT 1.06 TO 1.10 MeV
G. K. Khomyakov et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 377–379 refs (See N69-26751 14-23)
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The mechanism of proton polarization is examined from experimental and theoretical data at excitation levels of 11.0 to 11.4 MeV. Angular distribution and differential cross sections of polarization, parity, resonance half-widths, and spin are considered. E.E.B.

N69-26757# Israel Program for Scientific Translations, Ltd., Jerusalem.
ANALYSIS OF DIFFERENTIAL CROSS SECTIONS OF THE REACTION Al^{27} (α,t) Si^{28} IN THE DISTORTED WAVE APPROXIMATION
O. F. Nemets et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 391–394 refs (See N69-26751 14-23)
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An expression was derived for the (α, t) differential cross sections in the distorted wave approximation using current stripping theories. It was then applied to analyze the angular distributions of two groups of tritons from the reaction $Al^{27}(\alpha, t)Si^{28}$ (E_α = 27.2 MeV). Plots were made of the cross sections from theory and experiment and an analysis showed a good agreement at small angles. B.P.

N69-26774# Israel Program for Scientific Translations, Ltd., Jerusalem.
ON A POSSIBLE 7/2 OCTET
I. I. Kostyrko *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 466–467 refs (See N69-26751 14-23)
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The masses and other quantum characteristics of as yet undiscovered resonances with spin and parity 7/2 − were calculated making use of new experimental data pertaining to the discovery of some 7/2 − baryon resonances. Two 7/2 − resonances were recently discovered; these are $N^*_{1/2}(2190)$ and $Y_0(2120)$ having the following isospins and strangeness: (1) $T = 1/2$, $S = 0$; (2) $T = 0$, $S = -1$. As a working hypothesis the existence of another two resonances (Y^*_1 and ξ^*) of 7/2 − spin and parity was assumed having the following isospins and strangeness: (1) $T = 1$, $S = -1$; (2) $T = 1/2$, $S = -2$. The masses of the Y^*_1 and ξ^* resonances are calculated from the Gell-Mann formula for a baryon octet and the formula for the mean mass of a baryon multiplet of negative parity. Author

N69-26777# Israel Program for Scientific Translations, Ltd., Jerusalem.

STEADY-STATE LIGHT CHARACTERISTICS OF IMPURITY PHOTOCONDUCTIVITY DUE TO SENSITIZING CENTERS IN CdS

A. A. Ptashchenko *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 471–474 refs (See N69-26751 14-23)

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The fact that impurity photoconductivity in CdS is associated with sensitizing centers, and that light absorbed by the impurities induces double optical transitions, that is, both excitation and quenching transitions, is discussed. The existence of quenching transitions alters the impurity photocurrent response of CdS as compared to current-illuminance characteristics (CIC) of ordinary impurity photoconductivity. A diagram of photoexcited electron transitions in the region of impurity absorption, which contains sensitivity centers and fast recombination centers, is presented. Trap levels are allowed for by the neutrality conditions. Equations from which the CIC can be determined are supplied. Current-illuminance characteristics of CdS at various wavelengths are investigated; the impurity photoconductivity centers are identified as sensitivity centers, and the significance of quenching transitions is confirmed. It is noted that the CIC in the region of small photocurrents is sublinear only if sufficiently long wave illumination is used. In the short wave region, the photocurrent markedly decreases. P.A.B.

N69-26780# Israel Program for Scientific Translations, Ltd., Jerusalem.

MEASURING POLARIZATION OF PROTONS ELASTICALLY SCATTERED BY OXYGEN

N. N. Pucherov et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 479–482 refs (See N69-26751 14-23)

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The polarization excitation function was measured at energies of from 2 to 3 MeV for laboratory angle of 60°. For 2.5 MeV protons, the angular distribution of polarization in the range from 45 to 110° was also obtained. Polarization measurements were carried out for double proton scattering by gas targets. The experimental scheme, using oxygen and helium targets, is described, and asymmetry measurements discussed. The results of the polarization measurements are given in tabular form. Values for the polarization of protons elastically scattered by oxygen at a laboratory angle of 60° are found to be in good agreement with values computed from phase shifts for a laboratory scattering angle of 46.2°. The measurements confirm the finding that phase analysis based on cross section data while ignoring polarization gives exaggerated results for polarization in large angle scattering. P.A.B.

N69-26781# Israel Program for Scientific Translations, Ltd., Jerusalem.

RELATIONSHIP BETWEEN ELECTRICAL TRANSFER AND RESISTANCE PARAMETERS OF IMPURITY ATOMS IN LIQUID CADMIUM

A. Z. Zhmudskii et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 482–485 refs (See N69-26751 14-23)

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Concepts applying the quasi-gaseous model of liquid metal structure to derive equations that describe the resistivity and electrical transfer of liquid binary alloys as a function of concentration are used to show a relationship between the electrical transfer and resistance parameters. An experimental determination of this relationship and of the electrical transfer parameter was performed for seven impurities in liquid cadmium at 400°C. The results are compared with previous findings. The number of conduction electrons per atom in liquid Cd is approximated and experimentally found to be almost equal to the valence of Cd. Using the data for resistance and electrical transfer, the scattering cross sections of impurity atoms are calculated. Resistance and electrical transfer coincide within the margin of experimental error, confirming the quasi-gaseous model of liquid metal structure. P.A.B.

N69-26783# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE DIFFERENTIAL CROSS SECTION FOR LARGE-ANGLE ELASTIC SCATTERING OF 4-8 keV ELECTRONS AS A FUNCTION OF THE ATOMIC NUMBER OF THE TARGET

N. G. Nakhodkin et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 489–490 refs (See N69-26751 14-23)

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Experimental verification of the finding that the cross section for large angle elastic scattering of electrons by heavy atoms is at variance with the Rutherford formula is reviewed. In an attempt to determine to what extent the differential scattering cross section is at variance at medium energies, the relative changes were estimated for 4 to 8 keV electrons for targets of differing atomic numbers. The number of elastically reflected electrons in a small solid angle for several different targets were measured at energies close to the initial energy of the particles. The energy spectra of inelastically scattered electrons were measured, using the Hughes–Rozhanskii condenser, with targets of vacuum deposited layers of Be,Al,Cu,Ag,Au. The results are given in graphical form. The experimental data for heavy targets are shown to be higher than that obtained from the Rutherford expression, and are in good qualitative agreement with findings calculated by more exact numerical methods. It is concluded that the Rutherford formula should be replaced by more complex expressions for the scattering cross section in exact calculations of inelastic scattering at medium energies. P.A.B.

N69-26784# Israel Program for Scientific Translations, Ltd., Jerusalem.

HYPERON WEAK RADIATIVE DECAYS AND THE QUARK MODEL OF ELEMENTARY PARTICLES

M. P. Rekalo *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 491–492 refs (See N69-26751 14-23)

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Weak radiative decays of hyperons are considered within the framework of the quark model. Three particle decay is described as a four-tail diagram, where the quark content of each tail is known. According to the quark conception, the amplitude of the decay process can be obtained additively from the scattering amplitudes of the individual quarks; this procedure is illustrated schematically, and it is made clear that everything is determined by two quark amplitudes: the annihilation amplitude and the quark-quark scattering amplitude. Relations are derived between the amplitudes of the hyperon weak radiative decays. The assumption that the model is applicable to parity-changing decays is justified. A slightly different model is then described, where it is supposed that nothing is assumed concerning the quark content of the hyperons and that the quark-hyperon scattering amplitude obeys the SU(3) symmetry. The amplitude relations are replaced by different equations. When radiative decays are treated in the SU(3) symmetry, it follows that parity-changing radiative decays are forbidden. P.A.B.

N69-26733# Israel Program for Scientific Translations, Ltd., Jerusalem.

ENERGY LOSSES OF 8keV ELECTRONS IN A TWO-LAYER BERYLLIUM-GOLD TARGET

N. G. Nakhodkin et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 511–513 refs (See N69-26751 14-23)

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Thin films, transparent to low and medium energy electrons, were prepared by condensation in a high vacuum in order to be

free from impurities and oxides, and were used to assess the energy losses of 6 keV electrons per unit path length. A base of high atomic number was chosen, so that many of the inelastically reflected electrons had energies close to the initial value of 6 keV. The targets constituted a wedge-shaped beryllium layer on a gold base, vacuum deposited onto a level glass surface. Figures are presented which show typical energy distribution curves of inelastically reflected 6 keV electrons for beryllium targets of various thicknesses, and which compare mean and modal energy losses in the two-layer target as they change with increased Be thickness. P.A.B.

N69-26795# Israel Program for Scientific Translations, Ltd., Jerusalem.

A STUDY OF THE STIMULATED EMISSION OF RADIATION BY $CdS_x/CdSe_{1-x}$ CRYSTALS FOLLOWING TWO-PHOTON EXCITATION

M. S. Brodin et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 515–517 refs (See N69-26751 14-23)
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Lasering spectra were obtained for several crystals of various compositions at temperatures of 100° to 77°, 20°, and 4°K. Investigations revealed a variation of the lasering mechanism and frequency with temperature. The experimental results are compared with the theory of laser action; it is noted that when the temperature is less than 20°K, the crystals are characterized by bound-exciton lasering, whereas at 77° to 100°K, free-exciton lasering is observed with the participation of a longitudinal optical phonon. P.A.B.

N69-26797# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTERACTION OF SPIN WAVES WITH POLARONS IN AN EASY-PLANE FERRODIELECTRIC

E. G. Petrov *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 519–520 refs (See N69-26751 14-23)
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The fact that the exchange interaction between the electrons responsible for the ferromagnetism and the electrons responsible for the creation of polarons leads to spin wave damping is reviewed. The damping of spin waves is largely due to the magnetic dipole interaction with a Hamiltonian. The ferrodielectric Hamiltonian is obtained, and the time rate of change of spin waves of the wavevector due to the interaction is described by a kinetic equation. Expressions are derived for the damping ratio of spin waves for a weak magnetic field. It follows that the damping at approximately 1° K and at polaron concentrations of approximately 10^{-3} to 10^{-4} cm^{-3} (density 10^{19} to 10^{18} cm^{-3}) is of the order of 10^{8} sec^{-1}. P.A.B.

N69-26798# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE EXCITATION FUNCTION OF THE REACTION AL 27 (p, γ) Si 28 AT 2300 to 3200 KeV

A. A. Koval et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 521–523 refs (See N69-26751 14-23)
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Results obtained for the gamma ray yield as a function of proton energy in the reaction $Al^{27}(p,\gamma)Si^{28}$ for E_p = 2300 to 3200 keV are summarized. The computations of the excitation function were carried out on the DNEPR analog computer. The method of measurement is outlined; the results were displayed simultaneously as a digital printout and as a plot of the excitation function. Data are presented for the resonances and corresponding excitation energies of Si^{28} nuclear levels. Graphs drawn by an on-line plotter for the reaction are included. P.A.B.

N69-26800# Israel Program for Scientific Translations, Ltd., Jerusalem.

POLARIZATION OF PROTONS ELASTICALLY SCATTERED BY CALCIUM

V. S. Prokopenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 526–527 refs (See N69-26751 14-23)
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The polarization of 6.8 MeV protons elastically scattered by a 200 keV calcium target, using the double scattering technique, is analyzed. The experimental results are listed in tabular form. High negative polarization at scattering angles around 70°, with a deep dip occurring at the same angles as in the 14 to 17 MeV energy range, and a marked departure of the angular distribution of polarization at these angles from that observed for 8.6 MeV protons, are noted. P.A.B.

N69-26814# Atomic Energy Commission, N.Y. Health and Safety Lab.

DETERMINATION OF RADON PROGENY IN AIR FROM ALPHA ACTIVITY OF AIR SAMPLES

Jess W. Thomas Nov. 1968 39 p refs
(HASL-202) Avail: CFSTI

A simple, accurate set of three equations is derived for calculating the air concentration of radium A, radium B, and radium C. These equations are an improvement of the original Tsivoglou, Ayer, and Holaday equations because the air concentrations are given directly and the intermediate step of calculating the number of atoms of each isotope on the filter paper is unnecessary. Build-up and decay equations, for the three isotopes, of various investigators are converted to the same terminology, compared, and checked for accuracy. Close agreement is found in all cases, except for a numerical error in the air concentration equation for RaC of Tsivoglou, Ayer, and Holaday. Author (NSA)

N69-26845 Texas Univ., Austin.

POTENTIAL ENERGY SURFACES FOR LINEAR DIVALENT HELIUM MOLECULAR HYDROGEN COMPLEX

Donald Frank Zetik (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-16165

Ab initio ground state potential energy surfaces are presented for linear $^1\Sigma^+ HeH_2^{++}$. They are based on computations with a sixteen-term, configuration interaction wave function. The terms were constructed in the valence bond formulation from a basis set of 1s Gaussian orbitals. The variation principle was employed to optimize the linear and nonlinear parameters of the wave function. This optimization was performed for each computed nuclear geometry. The potential surface of the electronic configuration $He^+ + H_2^+$ crosses (in zero order) the surface for the configuration $He + H^+ + H^+$. Since the wave functions for these electronic configurations have the same symmetry, the no crossing rule applies. Features of the second potential surface illustrate the no crossing effect. Dissert. Abstr.

N69-26847 Johns Hopkins Univ., Baltimore, Md.

INVESTIGATIONS OF: VIBRATIONAL ENERGY EXCHANGE, ZERO-DIFFERENTIAL-OVERLAP THEORY OF MOLECULAR STRUCTURE, AND ATOMIC APPROXIMATIONS

John Healy Weare (Ph.D. Thesis) 1968 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-16494

A model for the collinear collision of an atom with a diatomic is discussed. Only interactions between adjacent atoms are considered. The diatomic is approximated by a harmonic oscillator and the projectile interaction with the target molecule by an exponential repulsive potential. The first, second and third order terms in a distorted wave Born expansion of the transition matrix

are calculated. The distorted wave expansion of the reaction matrix, K, is investigated. A simple approximation formula relating single and multiple quantum transitions is also given. A variation iteration procedure for calculating transition matrix elements is given. A variation principle for discontinuous trial functions is derived and its application to energy calculations briefly discussed. The results are reported of variational calculations on first row atoms and ions. Single-determinant trial functions are used. Nuclear-electron cusp conditions are derived and are applied in some calculations to reduce the number of independent parameters. Dissert. Abstr.

N69-26849 Houston Univ., Tex.
THE USE OF DOUBLE IRRADIATION EXPERIMENTS TO ANALYZE COMPLEX NUCLEAR MAGNETIC RESONANCE SPECTRA
Billy Joe Fairless (Ph.D. Thesis) 1968 248 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-11147

A description of multiple irradiation NMR experiments is followed by the analysis of the spectra of the retinal isomers. Several NMR spectra of the retinal isomers serve to exemplify both the double irradiation experiments and their practical use as an aid in the analysis of complex NMR spectra. Double irradiation experiments are also used as an aid to the more complex computer analysis of the cyclobutanone spectrum. The NMR spectrum of cyclobutanone was obtained at 40, 60, and 100 MHz. Double irradiation experiments were performed and the results compared at 40 and 100 MHz. The logic, use, advantages, and disadvantages of the Swalen-Reilley and LAOCOON computer programs are also given. Dissert. Abstr.

N69-26857 Pittsburgh Univ., Pa.
SPECTROSCOPIC STUDIES OF THE NUCLEI IN THE MASS REGION 90 TO 124 VIA THE (d,p) REACTION
James Bennett Moorhead (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-16637

Deuterons used in this study were provided at a bombarding energy of 12.0 MeV using the tandem Van de Graaff accelerator. Proton energy spectra were obtained with an energy resolution of 7 to 9 keV using an Enge split-pole spectrograph as an analyzer and photographic emulsions as detectors. The *l*-values are assigned to each of the transitions by examining the shapes of the angular distributions of the cross sections of proton groups. Values of j are assigned from the systematics of the region and (d,t) corroboration where necessary. Spectroscopic factors are calculated for each of the transitions and occupation numbers are assigned to each of the single particle levels in the nuclei. Centers of gravity are calculated and used to obtain single particle energies for each of the single particle levels. The occupation numbers, centers of gravity, and single particle energies of each of the single particle levels are compared among the isotopes studied. Dissert. Abstr.

N69-26859 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE MAGNITUDE AND SIGN OF THE $K_L K_S$ MASS DIFFERENCE
Joseph Marshall Canter (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-17610

Two experiments have been performed to measure the mass difference Δm between the long and short-lived neutral K mesons. The data were obtained at the alternating gradient synchrotron from three exposures of the 30-inch bubble chamber, filled with deuterium, to a beam of 600 MeV/c positive K mesons. $\bar{K}^*$s were produced by the reaction $K^+ d \rightarrow K^* p p$, and the mass difference was measured by monitoring the time dependence of subsequent strong interactions of the neutral K's. In one experiment, the magnitude of Δm was measured by studying $\bar{K}^*$ interactions that lead to the decay $\Lambda \rightarrow \pi^- p$. 165 events were found which satisfied appropriate selection criteria and the likelihood function for Δm was constructed. This yielded the value $|\Delta m| = 0.65 \pm 0.14$, in units of inverse K_S lifetimes, in agreement with determinations of the mass difference by other methods. Dissert. Abstr.

N69-26868# Lockheed Missiles and Space Co., Palo Alto, Calif.
EFFECTIVE ABSORPTION CROSS SECTION OF ULTRAVIOLET RADIATION BY MOLECULAR OXYGEN AT 3,000–10,000°K TEMPERATURES
S. A. Losev et al 1969 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 10, no. 2, 1969 p 228–232
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The effective absorption cross-sections of ultraviolet radiation in the range of bands and the Schumann–Runge continuum for O_2 are measured in the λ=1640 Å to 2245 Å band. Oxygen (mixed with argon) was heated to high temperature in a shock wave propagated in a shock tube. The optical properties of the gas were investigated at those times which corresponded to the build-up of equilibrium in the vibrational and rotational degrees of freedom of the O_2 molecule, but in the absence of any notable molecule dissociation. Author

N69-26887 Wisconsin Univ., Madison.
SPIN-EXTENDED SCF CALCULATIONS
Kenneth Martin Sando (Ph. D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-13659

A technique is developed for performing spin-extended self-consistent field calculations and is applied to several pi electron systems and first row atoms. The pi electron computations were carried out in the Pariser-Parr-Pople approximation. Energies and spin densities are reported for the odd alternant pi electron radicals allyl, pentadienyl, and benzyl, for the radical anions and cations of napthalene, anthracene, and azulene, and for the lithium, boron, and nitrogen atoms. The results are compared with experiment and with the results obtained from other methods of calculation. Dissert. Abstr.

N69-26906# Israel Program for Scientific Translations, Ltd., Jerusalem.
POLARIZATION PHENOMENA IN THE DIFFRACTIONAL INTERACTION OF Li^6 WITH NUCLEI
V. K. Tartakovskii et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 529–534 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

The interaction of beams of weakly coupled light nuclei of cluster structure with high-energy nuclei can be described by a diffraction mechanism. Spin-orbital interaction between the clusters and the target atoms will cause polarization of the elastically scattered cluster nuclei and polarization of their diffractional disintegration products. In the present report we show how to allow for the spin-orbital interaction of the deuteron cluster in Li^6 with the target nucleus and derive the vector and tensor polarizations of elastically scattered Li^6 nuclei and of the deuterons produced by Li^6 disintegration. The diffraction mechanism will automatically allow for spin-orbital interaction if in the general relations for the amplitudes of elastic scattering and disintegration of a weakly coupled two-cluster nucleus the parameter characterizing the diffractional interaction of the lighter cluster (deuteron in our case) with the scattering nucleus is replaced by the operator as is usually done for nucleons. Author

N69-26908# Israel Program for Scientific Translations, Ltd., Jerusalem.

LOW-ENERGY EXCITATION OF ODD NONAXIAL NUCLEI

I. E. Kashuba *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 545–552 refs (See N69-26905 14-23)

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The subdivision of the nuclear nucleons into internal (core) and external is somewhat questionable in the case of odd nuclei, since there is a possibility of pairing correlations in a nucleus with an external nucleon resulting in an increase of the nuclear moment of inertia. In this paper, assuming a nonaxial shape of the core and conservation of the total angular momentum of the external nucleon, we calculate the spins and the excited energy levels of odd atomic nuclei with $165 < A < 181$ and $A \approx 250$, whose ground-state spin is 7/2. Analysis of our results will define with greater precision the limits of applicability of the various approximations. Author

N69-26909# Israel Program for Scientific Translations, Ltd., Jerusalem.

ON THE FEASIBILITY OF EXPERIMENTAL VERIFICATION OF THE IMMOVABLE SCATTERING-AMPLITUDE SINGULARITY AT ZERO FIELD COUPLING CONSTANT IN RENORMALIZABLE THEORIES

Yu. M. Lomsadze et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 553–557 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

The following two methods are proposed for detecting the immovable singularity in the non-relativistic scattering amplitude at the point $\lambda = 0$: (1) comparison of the Mittag-Leffler amplitude with experimental findings for judging the presence or absence of an immovable amplitude singularity by information contained in the coefficients of a finite number of terms in the renormalized perturbation series for this amplitude; and (2) appropriate analytical continuation of the coefficient function U in the complex plane. The first technique is effective for calculating amplitudes of strongly interacting particles at any energy, and the second especially suitable for asymptotically high energies. G.G.

N69-26910# Israel Program for Scientific Translations, Ltd., Jerusalem.

PARAXIAL MOTION OF CHARGED PARTICLES IN A SPACE-MODULATED MAGNETIC FIELD

R. I. Kovtun *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 558–562 refs (See N69-26905 14-23)

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This paper deals with the motion of charged particles in a constant magnetic field constituting a superposition of a relatively strong homogeneous field and an axially symmetric perturbation, which is a periodic function of the coordinate z (reckoned along the field symmetry axis). The motion of a charged particle in a modulated magnetic field of this kind is resonant if the particle completes one circuit of the cyclotron orbit while passing through one period of the spatial perturbation. If the charged particle passes in its helical orbit near the OZ axis, where the axisymmetric perturbation is close to zero, the change in particle velocity is only caused by the perturbation far from the field axis, clearly a nonlinear effect which builds up with time. The problem was solved by applying the modification of the Krylov–Bogolyubov asymptotic method for the case of a slowly varying parameter entering the coefficients of the quasiharmonic equation; the variation of the parameter is known and it is described by a first-order equation which should be solved simultaneously with the quasiharmonic equation. Author

N69-26911# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROPAGATOR IN THE NONRENORMALIZABLE THEORY

M. Sh. Pevzner *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 563–566 refs (See N69-26905 14-23)

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Considered is the propagator of a scalar particle interacting with a massive vector field by: (1) establishing the existence of a finite solution for the equation of the nonrenormalized propagator of a scalar particle in the ladder approximation; (2) considering the various aspects of mass and propagator renormalization in the ladder approximation; and (3) analyzing the asymptotic behavior of the propagator in the renormalized theory. Results show that in the ladder approximation the equation of the nonrenormalized propagator of a scalar particle interacting with a massive vector field is solvable by satisfying the boundary conditions at the ends of the integration interval. Application of this solution for calculating field increments of particle mass and propagator renormalization constants show that they are finite. Author

N69-26912# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE THEORY OF HOLE MOTION IN A MAGNETIC FIELD IN THE HEITLER-LONDON-HEISENBERG APPROXIMATION

D. I. Sheka *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 567–576 refs (See N69-26905 14-23)

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A many-electron approach is used to form the relevant matrix elements in terms of atomic characteristics and parameters for hole motion in germanium and sodium chloride-type crystals under external magnetic fields. In this method, the hole coordinate remains uncertain to within the size of the atom and takes on discrete values only; the Hamiltonian is a function of the coordinates of all the electrons in the crystal. G.G.

N69-26922# Israel Program for Scientific Translations, Ltd., Jerusalem.

EXCITATION OF NOBLE GASES ELECTRON-ATOM COLLISIONS. 3: ARGON

P. V. Feltsan et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 632–638 refs (See N69-26905 14-23)

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Spectroscopically pure argon was used, and contamination was avoided with the aid of pulverized metallic absorbers and liquid-nitrogen cooled oil vapor traps. Measurements were carried out for optimal current density, optimal electron energy, and optimal argon pressure. Relative excitation functions and the absolute cross sections were measured in $(0.7–3) \times 10^{-3}$ mm Hg argon with beam currents i = 5–100 mA, corresponding to current densities $j = (0.1–3)\ 10^{-3} A/cm^2$. The energy spread of beam electrons under working conditions did not exceed 1.2 eV. Direct measurements were made of the excitation function and the effective excitation cross section for 75 spectral lines at wavelengths between 4000 and 9800 Å for electron energies from excitation threshold to 100 eV. The excitation functions obtained were characterized by rapid initial growth, reaching the maximum 7–10 eV above the threshold. Results compared reasonably well with previous investigations. K.R.G.

N69-26947 Washington Univ., Seattle.

ELECTRON SPIN RESONANCE INVESTIGATION OF THE ELECTRON MAGNETIC DIPOLE-DIPOLE INTERACTION

James Rufus Norris, Jr. (Ph.D. Thesis) 1968 166 p

Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-17198

The electron spin resonance (ESR) spectra of certain electronic ground state systems containing two unpaired electrons were

determined as a function of temperature. The variation of the spectra with temperature is ascribed to the effect of thermal tumbling motion on the electron magnetic dipole-dipole interaction. Two different applications of the density matrix method are employed to calculate spectra for comparison with experiment. "Mixed" chelates (zinc chelates containing only two ligands, and each ligand different) having an unpaired electron on each ligand were synthesized by a procedure that resulted in mixtures of the mixed chelate and the "parent" chelates (chelates containing two identical ligands). The ESR spectra indicate that the zero field ground state triplet levels of the mixed chelates are non degenerate.
Dissert. Abstr.

N69-28949 State Univ. of New York at Buffalo.
LOW ENERGY K^-–p ELASTIC INTERACTION
Gerald Paul Thomas (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: $6.20/Microfilm $3.00 Order No. 68-17334

The elastic interaction of K^-mesons with protons in the 0-250 MeV/c momentum range has been investigated in nuclear emulsion in this experiment. In the present experiment, the K^- beam was obtained at the Berkeley Bevatron. It had a flux density of about 1.3×10^3 particles/cm^2. The momentum spread was approximately 50-350 MeV/c. The incident kaon average kinetic energy was ~30 MeV. The maximum angular divergence was ~35°with respect to the normal from the edge of the plate where the beam enters. A total of 29,000 stars were produced from K^-capture at rest and found from area scanning. All capture stars were carefully scrutinized for purposes of their identification. A total of 28,975 traces were made backward from the capture stars along the primaries in order to find elastic events. Out of a few hundred stars recorded, 54 stars appeared to be elastic events.
Dissert. Abstr.

N69-28968*# Virginia Polytechnic Inst., Blacksburg.
THE 2p → 1s PIONIC TRANSITION
D. K. Anderson, D. A. Jenkins, and R. J. Powers [1969] 27 p refs
(Contract NGL-47-004-033)
(NASA-CR-66790) Avail: CFSTI CSCL 20H

In an attempt to get better agreement between the theoretical predictions and the observed energies and widths of 2p→1s pion-atomic transitions, we have numerically integrated the Klein–Gordon equation assuming the optical model for the strong interaction potential. We have characterized the interaction by six s-wave and four p-wave parameters. Using the available data from $_5B^{10}$ to $_{12}Mg^{24}$, we have performed a least squares fit of the s-wave parameters. We find agreement between the observed shifts and our predictions and the real parts of the s-wave parameters agree well with those predicted by the Ericsons. However, our predicted widths vary as much as 50% from the observed widths and find very poor agreement between the imaginary s-wave parameters and the Ericsons' predictions.
Author

N69-28971 Indiana Univ., Bloomington.
APPLICATIONS OF RADIOISOTOPES IN POLAROGRAPHY
Emil Wildman (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-15471

A procedure has been devised whereby accurate radioactivity-voltage curves may be obtained from a solution containing a radioactive isotope of an ion that reduces to an amalgam. The radioactivity appearing in the amalgam parallels the polarographic current. If sufficient precaustions are taken, the shape of the radioactivity *vs.* voltage curve corresponds to theory, i.e., a plot of log $(i_d - a)/a$ versus E_{de} (a being radioactivity) is linear with a slope of RT/nF. The method was tested with reversibly reduced thallous ion containing thallium–204, a beta emitter. So called "radiopolarograms" were also obtained using several other isotopes.
Dissert. Abstr.

N69-28972 Johns Hopkins Univ., Baltimore, Md.
MOSSBAUER EFFECT STUDIES FOLLOWING COULOMB EXCITATION OF Dy SUP 162, Dy SUP 164, AND U SUP 238
James Robert Oleson (Ph.D. Thesis) 1968 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-16455

The Mössbauer effect following Coulomb excitation of the first 2^+ states by Dy^{162}, Dy^{164}, and U^{238} has been studied. In experiments with a metallic uranium target and U_3O_8 absorber poorly resolved hyperfine structure which was temperature dependent was observed. The maximum resonant absorption in the spectra was 1.7%. observation of resonant absorption itself is significant and shows that the Coulomb excitation technique may be used for Mössbauer studies in an actinide. The hyperfine structure of Dy^{162} and Dy^{164} in a split by $DyFe_2$ absorber was obtained by using an unsplit target of $Dy^{162}Sb$ and $Dy^{164}Sb$, resp. Excited state moments have been measured by the angular correlation of radiation, by the Mössbauer effect with a radioactive source, by the Mössbauer effect following an (n,γ) reaction, and by the Mössbauer effect following Coulomb excitation. The moments determined by these methods all agree within experimental error.
Dissert. Abstr.

N69-28973 North Carolina State Univ., Raleigh.
STUDIES OF DIFFUSION PARAMETERS OF HETEROGENEOUS SYSTEMS AND SYSTEMS WITH VOIDS BY THE PULSED NEUTRON TECHNIQUE
Willie Ocasio-Cabanas (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-14668

Decay constants of thermalized neutrons produced by a pulsed 1 MeV Van de Graaff accelerator were measured for different cylindrical systems. These systems consisted of discs stacked to different heights to form homogeneous volumes and combinations of setups with a central void, an annular void, an array of multiple holes, and a heterogeneous system of lucite and aluminum discs. Systematic analysis of the data showed that for the range of bucklings measured the linear fit for which the diffusion cooling coefficient C = 0 resulted in much better agreement than the quadratic fit. Results from the linear fit of the homogeneous cases were used in the analysis of the data obtained with the systems of central voids and annular voids. In each case, theoretical analyses based on diffusion theory were applied. The various theoretical methods were compared with each other and with the experimental data.
Dissert. Abstr.

N69-28979# RAND Corp., Santa Monica, Calif.
TRANSPORT CALCULATIONS PERTINENT TO SATELLITE DETECTION OF DELAYED GAMMAS FROM AN ATMOSPHERIC NUCLEAR EXPLOSION
H. W. Hubbard and J. Marcum Jun. 1968 45 p refs
(AD-672719; RM-5626) Avail: CFSTI CSCL 18/3

A solution to the problem of measuring the transmission of delayed fission product gamma rays from atmospheric nuclear explosions from source to detector, assuming detection by a vela satellite or equivalent, calculations were made by means of a modification of the RAND X-Ray and Gamma-Ray Monte Carlo program (See RM-3596-PR), for each of the ten equal angular zones ranging from directly below the detector to the horizon, gamma fluxes were computed at two satellite altitudes–110,000 and 35,000 km–for source heights of 55,000 ft, 65,000 ft, 75,000 ft, and 100,000 ft. Five thousand Monte Carlo histories were

computed for each problem, requiring about 2.5 hours on the IBM 7044 for each. Numerical results are presented tabularly, in histograms, and with smoothed curves, average standard deviation is 20 percent, and smoothing cuts it approximately 10 percent. A second run of 5000 histories was made for the 65,000-ft source, using a new set of initial random numbers, to check this deviation, comparisons are made with results obtained using infinite medium buildup factors. Author (TAB)

N69-26989# Rochester Univ., N.Y. Nuclear Structure Research Lab.
THE STRUCTURE OF Ar 36 and Ar 38 VIA THE (He 3,d) REACTION ON Cl 35 AND Cl 37
M. A. Moinester and W. Parker Alford Apr. 1969 58 p refs Sponsored by NSF
(UR-NSRL-18) Avail: Issuing Activity

Deuteron angular distributions were measured for 31 levels in ^{36}Ar up to 8.5 MeV excitation and 29 levels in ^{38}Ar up to 6.9 MeV excitation. The l_p values and transition strengths were determined from a distorted-wave Born analysis of the angular distributions. The results for the positive parity states of ^{36}Ar and ^{38}Ar are in reasonable agreement with a shell model calculation which considers only $1d_{3/2}$ and $2s_{1/2}$ nucleons outside a closed ^{28}Si core. For the $f_{7/2}$ transitions in ^{38}Ar, and to a lesser extent in ^{36}Ar, the observed severe fragmentation of strength shows that a model involving core polarization rather than a simple weak coupling model is applicable in describing the structure of these nuclei. All the $p_{3/2}$ transition strength to $T_<$ states was accounted for in ^{36}Ar but only 12% in ^{38}Ar. It appears that the $p_{3/2}-f_{7/2}$ single-particle energy splitting is significantly smaller in ^{36}Ar than in ^{38}Ar. Author

N69-27011# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NEUTRON RESONANCES OF GADOLINIUM ISOTOPES
E. N. Karzhavina et al [1969] 31 p refs Transl. into ENGLISH from Russian Rept. JINR-P3-3882
(WAPD-Trans-108; JINR-P3-3882) Avail: CFSTI

The transmission and yield of γ rays from the neutron capture for ^{152}Gd, ^{154}Gd, ^{155}Gd, ^{156}Gd, ^{157}Gd, ^{158}Gd, ^{160}Gd isotopes were measured with the help of a neutron spectrometer of the neutron physics laboratory of the JINR. The parameters of the neutron resonances were determined, and some average characteristics of the Gd isotope nuclei were calculated. Author (NSA)

N69-27013# California Univ. Berkeley. Lawrence Radiation Lab.
MASS AND ENERGY DISTRIBUTIONS OF PHOTOFISSION FRAGMENTS OF U-238, Bi-209 AND Au-197 NUCLEI
B. A. Bochegov et al
Dec. 1968 22 p refs Transl. into ENGLISH from Russian Preprint No. 123 Sponsored By AEC
(UCRL-Trans-1383) Avail: CFSTI

Semiconductor detectors were used to study on the Kharkov U-2000 linear accelerator the mass and energy distributions P(U,Ek of photofission-fragment pairs of ^{238}U at $E\gamma$, max = 250, 600, and 1000 MeV and of ^{209}Bi and ^{197}Au nuclei at $E\gamma$, max = 1000 MeV. The results showed that in the fission of ^{238}U asymmetry of the mass distribution remains up to $E\gamma$, max = 1000 MeV. The minimum in the total kinetic energies of symmetrical nuclei is preserved at the same time. The photofission of ^{209}Bi and ^{197}Au leads to a predominantly symmetrical mass distribution and to a monotonic dependence of the total kinetic energy on the degree of the mass asymmetry of the fragments. The results on the fission of ^{209}Bi and ^{197}Au are compared with predictions of the Nix-Swiatecki theory. Author (NSA)

N69-27030*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NONDESTRUCTIVE EXAMINATION OF SURFACES WITH NEUTRAL ATOM PROBES Semiannual Progress Report
W. Walding Moore, Jr., Jens C. Zorn (Mich. Univ.), Denis P. Donnelly (Mich. Univ.), and John C. Pearl (Mich. Univ.). 19 Jul 1968 46 p refs Prepared by Mich. Univ., Randall Lab. of Phys.
(Contract NAS8-21267)
(NASA-TM-X-61698; MISC-SSL-68-1; SAPR-1) Avail: CFSTI CSCL 20H

The purpose of the research described in this report is to investigate the feasibility of monitoring the physical condition of a surface by observations of scattered beams of neutral, metastable atoms and molecules. The two primary properties of these scattered beams which are analyzed are the quench fraction, that is, the fraction of the metastables de-excited by collision, and the momentum accomodation of the beam molecules by the surfaces. Spin-off studies of value include the variation of the angular distribution of scattered molecules; the variation of the velocity distribution of molecules; and the surface residence time behavior of individual particles, all as a function of surface condition. Author

N69-27038 European Organization for Nuclear Research, Geneva (Switzerland).
GENERAL PROPERTIES OF FIELDS AND BEAM DYNAMICS IN A LINAC GAP
B. Schnizer 12 Mar. 1969 146 p refs
(CERN-69-3) Copyright. Avail: CFSTI

An extensive and detailed derivation of nonrelativistic and relativistic difference equations describing the motion of a single proton through an Alvarez structure linac gap is given. Integral representations of the field in such a gap are derived and their properties are discussed as well as those of the field amplitude which is proportional to the transit time factor. Beam dynamics coefficients are defined which are Fourier transforms of the fields. There are two types of them: T-coefficients which are known as soon as the transit time factor is given and which occur in difference equations describing the change of particle coordinates across the whole gap. In difference equations across the first half of it enter in addition the S-coefficients which are much more complicated. Beam dynamics equations are derived by first order perturbation theory regarding as perturbation the influence of the radio frequency field (with angular frequency ω) on free particle motion. This is equivalent to solving the equations of motion by iteration starting from free particle motion, but the present method is more definite. Author

N69-27040# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
HIGH ENERGY PROTON-PROTON SCATTERING IN THE EIKONAL MODEL
A. Capella, J. Kaplan, A. Krzywicki, and D. Schiff Jan. 1969 25 p refs
(LPTHE/69/11) Avail: CFSTI

The eikonal model for high energy pp scattering is extended to include spin effects. The single scattering corresponds to the exchange of a flat Pomeranchon and two (degenerate) secondary trajectories. A very simple parametrization with five arbitrary parameters is chosen. A good description was obtained of the pp data on total and differential cross sections, and of the ratio of real to imaginary part of the amplitude at $t = 0$ and polarizations for incident momenta between 5 and 20 GeV/c. Predictions for the pp high energy scattering are made. They are in reasonable agreement with the experimental data and exhibit the cross over effect near the right value of the momentum transfer. Some general features of the eikonal model are also discussed. Author

N69-27063 Rutgers Univ., New Brunswick, N.J.
SOME APPLICATIONS OF RENORMALIZATION THEORY TO RELATIVISTIC BOUND STATE PROBLEMS
Edward Kafrissen (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-17786

A relativistic potential model is examined for which the vanishing of the vertex renormalization constant (Z_1) as a bound state condition can be shown. This model consists of a Dirac particle scattering from a scalar potential. Alternate forms for Z_1 by considering the Dirac equation in both coordinate and momentum space are derived. Z_1 is identified as the Dirac Jost function function evaluated at the bound state energy so that for this model the condition $Z_1 = 0$ is the usual condition for a bound state. A dispersion relation for the nucleon (neutron, proton) wave function renormalization constant (Z_N) is shown to yield, in certain cases, a simple algebraic expression for Z_N. Taking the scattering amplitude due only to strong interaction forces, this expression is evaluated for Z_N and is found to be consistent with $Z_N = 0$.
Dissert. Abstr.

N69-27066# Istituto Superiore de Sanita, Rome (Italy). Laboratori di Fisica.
PROGRESS REPORT OF THE "SOTTOSEZIONE SANITA" OF THE INFN FOR THE PERIOD 1 JULY 1967 TO 30 JUNE 1968 [RELAZIONE SULL'ATTIVITA DELLA SOTTOSEZIONE "SANITA" DELL'INFN PER IL PERIODO DALL'1.7.1967 AL 30.6 1968]
22 Oct. 1968 24 p refs In ITALIAN
(ISS-68/39) Avail: CFSTI

Research work in the fields of elementary particle physics, nuclear physics, solid state physics and electromagnetic interactions is described. A brief account of the activities of the computing center is also given.
Author

N69-27084 Cornell Univ., Ithaca, N.Y.
EXPERIMENTAL STUDIES OF Ba 136m, Xe 134m, Xe 127m, AND Xe 125 m
Willard Gary Winn (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-16204

The isomers were produced by pulsed neutron irradiation of enriched and natural samples in the TRIGA and transported by fast pneumatic transfer to a counting station where gamma and conversion electron spectra were observed using NaI(Tl), Ge(Li), and Si(Li) detectors. Because of the short half-lives of the isomers investigated, special techniques were devised to provide fast positioning of the sample for detection. Ba^{136m} ($T_{1/2}$ = 307 ± 4 msec) and Xe^{134m}($T_{1/2}$ = 290 ± 17 msec) were studied with reference to analogous isomers in the N= 80 isotones. Each isomer decays by a three gamma cascade consistent with a 7$^-$ E3 4$^+$ E2 2$^+$ E2 0$^+$ scheme. Corresponding gamma energies are 168 ± 7, 1048.6 ± 0.7 and 819.3 ± 0.7 keV in Ba^{136m} and 232.9 ± 1.5, 879.9 ± 1.4, and 845.9 ± 1.0 keV in Xe^{134m}. The techniques developed for xenon gas samples in the Xe^{134m} experiments were applicable to investigation of other isomers in xenon. The isomers Xe^{127m}($T_{1/2}$ = 74 sec) and Xe^{125m}($T_{1/2}$ = 58 sec) were studied. Each was observed to decay by a two gamma cascade consistent with a 9/2$^-$E3 3/2$^+$ M1 1/2$^+$ scheme. The corresponding gamma energies are 172.5 ± 1 and 125.1 ± 1 keV in Xe^{127m} and 142.3 ± 0.5 and 112.1 ± 0.5 keV in Xe^{125m}.
Dissert. Abstr.

N69-27066 Indiana Univ., Bloomington.
NUCLEAR WAVE FUNCTIONS OF Zr 90 AND THE Zr 90 $(\alpha,\alpha'\gamma)$ REACTION
Donald Clarence Wold (Ph.D. Thesis) 1968 414 p
Avail: Univ. Microfilms: HC $18.70/Microfilm $5.30 Order No. 68-15473

The application of the shell model to the $^{90}Zr(\alpha,\alpha',\gamma)$ reaction is described. Computer programs were written for this analysis. The shell model orbitals are calculated for a potential of the Saxon-Woods shape. The central part of the Gammel and Thaler proton-alpha potential is used for the interaction between projectile and target nucleons. The parameters of the optical potential well are determined by fitting the elastic scattering, and the strength of the proton-alpha interaction is determined by fitting the inelastic cross section for exciting the 2$^+$ level at 2.18 MeV. The strength of the effective projectile-nucleon interaction required for the inelastic 2$^+$ excitation is approximately twice that required for elastic scattering of protons from ^{4}He. Core polarization is included in the coupled channel and distorted wave calculations. The nuclear wave functions of ^{90}Zr are varied by changing the $2p_{1/2}$ and $1g_{9/2}$ single particle wave functions.
Dissert. Abstr.

N69-27092# Rome Univ. (Italy). Inst. of Physics.
A NUMBER CONSERVING CALCULATION OF THE NUCLEAR SPECTRA OF THE ODD-MASS ISOTOPES OF Pb, Tl, Hg
N. Lo Iudice, D. Prosperi, and E. Salusti 31 Oct. 1968 22 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna 191
Avail: CFSTI

A calculation is reported of the low energy spectra of Pb, Tl and Hg odd-mass isotopes. The method here applied is a simplified version of a theory first suggested to treat pairing correlations in nuclei without violating particle number conservation (Jean-Klein theory). The residual nucleon-nucleon interaction is a (pairing + P_0) potential. The results of the present work are compared with those obtained by other models and by the experimental data.
Author (ESRO)

N69-27097# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
SOME FEATURES OF SCALER ELECTRODYNAMICS IN DISPERSION APPROACH
V. P. Pavlov, S. V. Svechnikov, A. D. Sukhanov, and N. I. Usyukina 1968 14 p In RUSSIAN; ENGLISH summary Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-68-23; CONF-680453-9) Avail: AEC Depository Libraries

The dynamical scheme of dispersion approach is applied to scalar electrodynamics. The effects of the renormalization of wave functions are accounted for. Higher current-like operators are found, and equal-time commutators of Heisenberg currents and fields are constructed.
Author (NSA)

N69-27098# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
THEORY OF NEUTRAL MASSIVE VECTOR FIELD IN DISPERSION APPROACH
V. P. Pavlov, S. V. Svechnikov, and A. D. Sukhanov 1968 14 p refs In RUSSIAN; ENGLISH summary Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-68-24, CONF-680453-10) Avail: AEC Depository Libraries

The dynamical scheme of dispersion approach is applied to the theory of a neutral massive vector field interacting with a spinor one. The effects of the renormalization of wave functions are accounted for. Higher current-like operators and equal-time commutators of Heisenberg currents and fields are constructed.
Author (NSA)

N69-27099# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
QUASILOCALITY OF A CLASS OF NONRENORMALIZABLE INTERACTIONS
S. S. Khoruzhii 1968 8 p refs Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-68-22; CONF-680453-5) Avail: AEC Depository Libraries

A certain model of axiomatic field theory is considered, which assumes an arbitrarily high exponential growth order of vacuum expectation values in the momentum space. It is proved that this model still possesses the property of quasilocality (in Haag's sense) and the corpuscular interpretation. Author (NSA)

N69-27111# Harvard Univ., Cambridge, Mass. Dept. of Physics.
BARYON RESONANCE PRODUCTION IN π^-p INTERACTIONS AT 13 BeV/c AND 20 BeV/c
G. W. Brandenburg, A. E. Brenner, B. Eisenstein, L. Eisenstein, M. L. Ioffredo et al Aug. 1968 15 p refs Presented at 14th Intern. Conf. on High Energy Phys., Vienna, 1968
(Contract AT(30-1)-2752)
(HUX-2752-44; CONF-680809-43) Avail: CFSTI

The events $\pi^- + p \rightarrow p + \pi^+ + \pi^- + \pi^-$ at 13 and 20 GeV/c and $\pi^- + p \rightarrow p + \pi^+ + \pi^- + \pi^- + \pi^0$ at 20 GeV/c were studied in a bubble chamber. Mass spectra are shown for strong N^{*++} (1236) production, N^* (1688) production, and an enhancement between 1.35 and 1.5 GeV/c^2. Also some ρ production is observed. The results are preliminary. NSA

N69-27116# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
ENERGY LEVELS OF TWO AND THREE NUCLEON PROBLEMS WITH YUKAWA POTENTIAL IN THE STRONG CONNECTION APPROXIMATION
I. V. Simenog 1968 10 p refs In RUSSIAN; ENGLISH summary
(ITF-68-80) Avail: CFSTI

Explicit dependence of energy levels of two nucleons interacting through Yukawa-type potential (singular at zero) on the coupling constant g is obtained in the framework of strong coupling approximation method. Generalization of the method also unifying previous results is presented for the case of arbitrary potential. Binding energy for three nucleons with Yukawa and Hulthen potentials is evaluated, the results being in good correspondence with numerical calculations carried out by means of the factorization method. Author (NSA)

N69-27119# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
ELECTRONIC PROPERTIES AND MAGNETIC ORDERING OF LIGHT RARE-EARTH METALS
Gerald Stephen Fleming (Ph.D. Thesis) Nov. 1968 72 p refs
(Contract W-7405-eng-82)
(IS-T-272) Avail: CFSTI

Energy bands have been calculated for the double hexagonal close-packed rare-earth metals lanthanum, praseodymium, and neodymium using the relativistic augmented-plane-wave method. From these bands the densities of states at the Fermi energy and Fermi surfaces were determined. The calculated densities of states are consistently lower than experimentally determined values with the difference being attributable to enhancement due to electron–phonon interactions. These Fermi surfaces all lack the large flat regions perpendicular to the c–axis which are present in all of the hcp rare–earth Fermi surfaces. The absence of this feature appears to indicate that the dhcp structure is energetically more favorable than an hcp structure for these metals. Using the Nd and Pr energy bands the generalized susceptibilities, $\chi(q)$, have been calculated for wave vectors lying in the Γ' MLA plane of the Brillouin zone. Author (NSA)

N69-27142# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
MASS RENORMALIZATION AND FIELD "DRESSING" MODEL
B. V. Medvedev, M. K. Polivanov, and A. D. Sukhanov 1968 11 p refs In RUSSIAN; ENGLISH summary Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-28; CONF-680453-8) Avail: CFSTI

The bilinear model of mass renormalization is explicitly solved, as well as the same model taking additionally into account field operator dressing by contributing an appropriate counterpart. The effect of this counterpart can be accounted for in two ways. One may either renormalize the charge without changing the functional field argument or renormalize the proper field argument without changing the charge. In both the cases one obtains self-consistent sets of relations which are to be a hypothesis on the renormalization character in a realistic theory. Author (NSA)

N69-27143# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
CONNECTION BETWEEN FORMFACTOR AND PHYSICAL S-MATRIX
V. E. Troitskii and Yu. M. Shirokov 1968 11 p refs In RUSSIAN; ENGLISH summary Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-25; CONF-680453-12) Avail: CFSTI

A method developed previously is employed to construct the connection between the two-particle matrix element of vector current and deuteron form factor on the one hand and the physical S-matrix on the other hand. Author (NSA)

N69-27160# Columbia Univ., New York. Dept. of Physics.
PEGRAM NUCLEAR PHYSICS LABORATORIES Progress Report, Jan. 1967–Jan. 1968
Jan. 1968 102 p refs
(Contract AT(30-1)-GEN-72)
(NYO-72-191) Avail: CFSTI

In the progress report presented, attention is focused on fission fragment and neutron cross sectional measurements, nuclear reactions with charged particles, beta and gamma spectroscopic measurements, and nuclear structures. Also discussed is work on neutron kinetics and interactions as well as electronic instrument developments for neutron physics. G.G.

N69-27189# Rome Univ. (Italy). Inst. of Physics.
LARGE ANGLE p-p SCATTERING, CERULUS-MARTIN BOUND AND THE VENEZIANO MODEL
M. Cassandro and M. Greco (Comitato Nazl. per l'Energia Nucl., Frascati, Italy) 2 Dec. 1968 15 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna 196
Avail: CFSTI

The Veneziano model, modified in order to satisfy the Cerulus-Martin bound, is shown to give a very good description of p-p elastic scattering over the full range of t, except for the diffraction peak. Author (ESRO)

N69-27204# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
PROBLEM OF "UNITARIZATION" OF RELATIONS BETWEEN OPERATORS IN THE HEISENBERG AND INTERACTION REPRESENTATIONS

A. D. Sukhanov 1968 16 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-27; CONF-680543-11) Avail: AEC Depository Libraries

It is shown that the relations between individual operators in the Heisenberg and interaction representations can be written in a formally unitary form if one employs a certain pseudo-unitary operator as the "half" S-matrix. However, relations between Heisenberg fields and their time derivatives can be "unitarized" only with the help of various pseudo-unitary operators. Thus, the connection between the two representations of canonical commutation relations in the real theory have canonical character rather than unitary one. Author (NSA)

N69-27205# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

HIGH ENERGY DIFFRACTION SCATTERING OF HADRONS AND THE QUARK MODEL OF ELEMENTARY PARTICLES INTERACTION

A. I. Akhiezer and M. P. Rekalo 1968 15 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-34; CONF-680453-2) Avail: AEC Depository Libraries

The high energy diffraction scattering of elementary particles is considered in the framework of the quark model. It is supposed that in the region of momenta of colliding hadrons not larger than 10 Gev/c the antiquark-quark scattering amplitude has two diffraction peaks while the quark-quark scattering amplitude exhibits only the principal diffractive peak. This difference stipulates the appearance of the second diffraction peak in the differential cross sections of the reections into whose amplitudes the annihilation quark mechanisms make contribution. Such a model presents a simple scheme for answering the question for which processes the diffraction picture should be observed or alternatively be, absent. This scheme enables one to find relations between differential cross sections in the region of the second diffraction peak. Author (NSA)

N69-27212# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

DERIVATION OF PARTIAL-WAVE AMPLITUDES WITH CORRECT THRESHOLD BEHAVIOR

G. N. Chermalykh 1968 9 p refs Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-68-41; CONF-680453-4) Avail: AEC Depository Libraries

Modifications of the Froissart inelastic function are suggested, allowing one to derive the partial-wave amplitude with the correct threshold behavior by the Froissart N/D-method. The possibility is discussed of deriving the correct threshold behavior of the partial-wave amplitudes $A_l(\nu)$ from the dispersion relations for $A_l(\nu)/W_l(\nu)$, $W_l(\nu) \underset{\nu \to \infty}{\sim} \nu^{\delta}$ being threshold functions with the lefthand cut, $W_l(\nu) = O(\nu)$, $\nu \to \infty$. Author (NSA)

N69-27220# Columbia Univ., New York.

POSSIBLE WAY TO REMOVE DIVERGENCE DIFFICULTIES IN PHYSICS

T. D. Lee (CERN) Feb. 1969 38 p refs Presented at Intern. Conf. on Weak Interactions, Geneva, Jan. 1969
(Contract AT(30-1)-1932)
(NYO-1932(2)-145; CONF-690107-2) Avail: CFSTI

The discussion of divergence difficulties in physics covers divergence difficulties in electrodynamics, and in the weak interaction, a possible solution to the divergence problem, and unitarity. A soluble model is given as an example, and quantum electrodynamics without divergence difficulties and modified Feynman rules are discussed. Lastly, possible experimental tests are considered. It is concluded that without some fundamental changes the divergences cannot be removed from quantum field theory. But the introduction of a negative metric and the possible existence of complex singularities may provide a way out of these difficulties. NSA

N69-27222# Oak Ridge National Lab., Tenn.

X-RAY DIFFRACTION ON DATA ON AQUEOUS AMMONIUM HALIDE SOLUTIONS AT 25°C

A. H. Narten Feb. 1969 57 p refs
(Contract W-7405-eng-26)
(ORNL-4367) Avail: CFSTI

The scattering of x-rays from the free surface of aqueous ammonium chloride, bromide, and iodide solutions ($NH_4X \cdot \approx 8H_2O$) was measured and analyzed at 25°C. Both the raw data and the intensity and radial distribution functions derived from them are presented in tabulated form. The curves for the three solutions are compared with previously obtained results for ammonium fluoride solutions and for pure water at the same temperature. Author (NSA)

N69-27230# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

NEW PROOF OF POMERANCHUK THEOREM

Yu. M. Lomsadze, S. S. Tokar, and E. E. Kontrosh 1968 13 p refs Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-30; CONF-680453-6) Avail: AEC Depository Libraries

Based on the modified Meyman theorem 3, a new proof of the Pomeranchuk theorem is given under the assumption that the difference of the amplitudes $A_+(E)-A_-(E)$ increases slower than E ln E. In contrast to the existing proofs of this theorem, in the new proof no additional mathematical assumptions are used, except for that of the absence of very strong oscillations of $\Delta\delta = \delta_+(E)-\delta(E)$ in an accurately formulated meaning. One takes into account, in particular, that the amplitudes $A_\pm(E)$ for real E are distributions rather than usual functions. Two other formulations of the Pomeranchuk theorem are also given, one of which weakens still more the restrictions on possible oscillations of $\Delta\delta(E)$ and the other contains no restrictions on these oscillations whatsoever. Author (NSA)

N69-27231 European Organization for Nuclear Research, Geneva (Switzerland).

STUDY OF AN ELECTROSTATIC SEPARATOR WITH MULTIPLE PLATE MODES TO BE USED FOR ENRICHING LOW ENERGY BEAMS TO HIGH INTENSITY [ETUDE DU SEPARATEUR ELECTROSTATIQUE A PLAQUES MULTIPLES MODES D'UTILISATION POUR L'ENRICHISSENENT DE FAISCEAUX DE BASSE ENERGIE A HAUTE INTENSITE]

D. J. Simon 21 Mar. 1969 61 p refs In FRENCH
(CERN-69-4) Copyright. Avail: Issuing Activity

The performances of two systems were studied: they used elevated electric fields to separate high energy particles between weakly isolated electrodes. The first system, a long multiplate separator, eliminated the nondesirable particles by collisions with the plates, while the second used angular separation produced by the small cells and an optical system for isolating undesirable particles (a short multiplate separator). The superiority of the short separator was demonstrated: the transmission of desired particles was larger, work was carried out at higher energies, and manipulation was easier. Transl. by B.P.

N69-27237# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FISSION PRODUCT TRANSPORT BY NATURAL PROCESSES IN CONTAINMENT VESSELS
J. G. Knudsen (Oregon State Univ.) and R. K. Hilliard Jan. 1969 98 p refs
(Contract AT(45-1)-1830)
(BNWL-943) Avail: CFSTI

A calculational procedure is developed and described for predicting the time-dependent concentration of molecular vapor forms of fission products contained in a closed vessel with a condensing steam-air atmosphere. The model predicts iodine behavior substantially as found by large-scale experiments in the 30,000 ft^3 containment systems experiment containment vessel. In seven large-scale experiments, elemental iodine transfer rate from the gas phase to surfaces averaged 8% lower than predicted by the model for the gas diffusion limiting period. Author (NSA)

N69-27238# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY CHEMISTRY AND PHYSICS Progress Report, Jul.–Sep. 1968
10 Feb. 1969 22 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1526) Avail: CFSTI

Research progress is reported on: the alpha–beta branching ratio of ^{227}Ac, electron transfer studies in thorium and uranium complexes with diketo ligands, recovery of ^{234}U from aged ^{238}Pu materials, recovery of ^{229}Th from ^{233}U, decontamination of ^{206}Pb, and the neutron energy spectrum of a ^{241}Am–Be(α,n source. NSA

N69-27240# Akademiya Nauk URSR. Kiev. Institut Teoreticheskoi Fiziki.
MODELS OF LOW-ENERGY SCATTERING WITH SHORT-RANGE REPULSION
G. N. Chermalykh 1968 8 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-40; CONF-680453-3) Avail: AEC Depository Libraries

The dependence of the solutions for the models of low-energy scattering with short-range repulsion on the form of two parameter effective nonlocal form factors is considered. It is shown that with a growing rate of the decrease of the form factor impulse Fourier-transform at infinity, the interval of permissible negative values for the scattering lengths extends noticeably, i.e., the low-energy description with two-parameter account for high-energy contributions is, in general, not closed. Author (NSA)

N69-27241# Lund Univ. (Sweden).
A SYSTEMATIC STUDY OF FAST NEUTRON ELASTIC SCATTERING IN THE ENERGY REGION 1.5 TO 8.1 MeV
Bertil Holmquist (Ph.D. Thesis) 1968 9 p refs
(NP-17773) Avail: Depository Libraries

A summary is presented of 3 published papers on the following subject: angular distributions of neutrons elastically scattered by natural Cu in the energy region 1.5 to 4.6 MeV; a Monte Carlo program for calculation of neutron attenuation and multiple scattering corrections; and a systematic study of fast neutron elastic scattering in the energy region 1.5 to 8.1 MeV. NSA

N69-27249# Polish Academy of Sciences, Warsaw. Inst. on Nuclear Research.
DENSITY-RATIO METHOD FOR LOCALIZING THE AXIS OF EXTENSIVE AIR SHOWER
Jerzy Jatczak 1968 24 p refs
(INR-P-944) Avail: AEC Depository Libraries

A method was developed for localizing the axes of individual showers by measuring the ratios of the densities of charged particles in the shower. With the assumption that the age parameter s = 1.25, nomograms were drawn for localizing the axes of showers in a 75-meter circle. Author (NSA)

N69-27251# European Organization for Nuclear Research, Geneva (Switzerland).
STUDY OF TEMPORAL DISTRIBUTIONS IN THE BEAM OF THE SYNCHRO-CYCLOTRON
Ph. Levy 1968 35 p refs In FRENCH
(CERN-68-43) Avail: AEC Depository Libraries

A detailed study was made of the temporal structures of the internal and external beam of the CERN synchrocyclotron. The purpose was to understand the functioning of the slow extraction system and to improve the duty cycle of the machine. The methods used for the measurement of the exact temporal distribution of the events, the distribution separating two events, and duty cycles are described. The gross and fine structure of the beam was determined for short bursts and slow extraction. The implications of this study for the new design are discussed with respect to the extraction efficiency with the present SLE system, efficiency-duty cycle compromise with the present system, and adaptation of the principal program. NSA

N69-27273# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF A PULSED DISCHARGE IN HYDROGEN USING THE FAR ULTRAVIOLET EMISSION OF AN ADDITIONAL ELEMENT: ELECTRON TEMPERATURE MEASUREMENT [ETUDE D'UNE DECHARGE PULSEE DANS L'HYDROGENE A PARTIR DE L'EMISSION DANS L'ULTRAVIOLET LOINTAIN D'UN ELEMENT ADDITIONNEL: MESURE DE LA TEMPERATURE ELECTRONIQUE]
Jean-Louis Schwob (Ph.D. Thesis—Paris Univ.) 1968 121 p refs
(CEA-R-3359) Avail: AEC Depository Libraries

Ionization and excitation of an additional element in a pulsed annular discharge in hydrogen at low pressure (T.A. 2000) are described by means of a simple coronal-type analytical model. This model allows one to interpret the time variation of the intensity of spectral lines observed in the vacuum-ultraviolet region. From this analysis two methods of electron temperature determination are deduced. The first method is based on the apparation time measurement of the intensity maximum for the spectral lines emitted from successive ions of the additional element (nitrogen). In the second method the electron temperature is determined from the intensity ratio of two spectral lines of an alkali-like ion. The transition couples (2s – 2p, 2s – 3p) and (2s – 2p, 3s – 3p) of C IV, N V and O VI have been used. The results obtained with these two independent methods are in good agreement. Author (NSA)

N69-27278# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
THE NEW SATURNE INJECTOR: ON THE 750-keV PREINJECTOR Status Report
J. Faure [1968] 16 p refs Presented at the Conf. on Expl. Methods in Nucl. and Particle Phys., Strasbourg, 12 Apr. 1968
(CEA-CONF-1199; CONF-681208-2) Avail: AEC Depository Libraries

A status report is presented on the new 750 keV preinjector for the 20 MeV linac of the Saturne proton synchrotron. The preinjector provides a 100 mA proton pulsed beam at the linac entrance. The pulse duration is 200 μsec and the beam emittance value at the output of the preinjector itself is, so far, 2.5×10^{-6} rad (normalized value). The preinjector is described. Emittance measurements are discussed. The ion optics between the preinjector and injector are also discussed. NSA

N69-27280# Brookhaven National Lab., Upton, N.Y. National Neutron Cross Section Center.
NUCLEAR AND PHYSICAL PROPERTIES OF Cf 252
A. Prince [1968] 111 p refs Presented at Am. Nucl. Soc. Symp. on Californium-252, New York Sponsored by AEC
(BNL-13251; CONF-681032-4) Avail: CFSTI

A review of the nuclear and physical properties of ^{252}Cf is presented on the basis of a survey of the available experimental data. Alpha and spontaneous fission properties are covered, as are neutron cross sections and the average number of prompt neutrons emitted in neutron-induced fission. 106 references. NSA

N69-27282# Hamburg Univ. (West Germany).
EQUAL TIME COMMUTATORS AND FORM FACTORS IN QUANTUM ELECTRODYNAMICS WITH INTERNAL SYMMETRY
J. Katz and J. Langerholc Deutsches Elektronen-Synchrotron Oct. 1968 50 p refs
(DESY-68/54) Avail: AEC Depository Libraries

The proposal that the equal time limit of commutators of current operators could be abstracted from simple models and postulated as exact is explored. Some features of equal time commutators between isospin currents are discussed in second order perturbation theory, in particular their connection with form factors and renormalization. The quantum electrodynamical interactions of photons with electrons and nucleons is considered. NSA

N69-27284# Brookhaven National Lab., Upton, N.Y.
SEARCH FOR DECAY $K^0_2 \rightarrow \pi^+\pi^-\pi^0$
D. Berley, P. Yamin, R. Kofler (Mass. Univ.), A. Mann (Mass. Univ.), and G. Meisner (Mass. Univ.) et al 1969 6 p refs Presented at Intern. Conf. on Weak Interactions, Geneva, 14–17 Jan. 1969 Supported by AEC
(BNL-13279; CONF-690107-1) Avail: CFSTI

The results of a search for the decay $K^0_1 \rightarrow \pi^+ + \pi^- + \pi^0$ are presented. A sample of K^0 was produced in the charge-exchange reaction $K^- + p \rightarrow n + K^0$ with 400 MeV/c incident K^- in the 30-inch BNL–Columbia hydrogen bubble chamber. The results are consistent with previous results and do not demand any CP violation. NSA

N69-27286# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
LOW-ENERGY RELATIONS IN MESON-MESON SCATTERING
V. G. Pisarenko 1968 28 p refs In RUSSIAN; ENGLISH summary
(ITF-68-37) Avail: CFSTI

For the scattering of pseudoscalar mesons on vector mesons a number of relations between the coupling constants are derived from the superconvergence sum rules with account for the lowest resonance states. The conditions are studied under which the relations of de Alfaro et al., are obtained. The saturation of superconvergence sum rules in the SU(3)-symmetry scattering by the meson 35-plet leads to the results predicted by the collinear $SU(6)_w$-symmetry. Author (NSA)

N69-27310# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
LOW BOUNDARY OF DECREASING FORM FACTORS
G. G. Volkov, V. V. Ezhela, and M. A. Mestvirishvili 1968 10 p refs In RUSSIAN
(IFVE-STF-68-32-K) Avail: CFSTI

A lower limit of form factors decreasing in the region of large momentum transfer is found. Exponential character of the decreasing of the pions and nucleons electromagnet form factors is estimated. Author (NSA)

N69-27332# California Univ., Berkeley. Lawrence Radiation Lab.
SEARCH FOR THE DIRECT DECAY MODES $K^+ \rightarrow \mu^+ + \nu + \gamma$ AND $K^+ \rightarrow \pi^+ + \gamma + \gamma$.
Min Chen (Ph.D. Thesis) Jan. 1969 99 p refs
(Contract W-7405-ENG-48)
(UCRL-18653) Avail: CFSTI

A search was made for the direct decays $K^+ \rightarrow \mu^+ + \nu + \gamma$ and $K^+ \rightarrow \pi^+ + \gamma + \gamma$ using spark chambers. For the former decay 27 events were found with muon kinetic energy between 137 and 142 MeV. Each of these events was associated with a converted gamma ray shower. The upper limit for the branching ratio of this decay is found to be 1.1 (10^{-5}) at 90% confidence level. For the second decay, out of 6780 events with good gamma ray showers 29 ± 5.5 events were found that fitted the decay hypothesis within the energy and spacial resolution. The branching ratio for the $K^+ \rightarrow \pi^+ + \gamma + \gamma$ decay has an upper limit of 1.1 (10^{-4}) at a confidence level of 90%. NSA

N69-27333# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
LAMBDA-NUCLEON INTERACTION
A. Deloff 1968 85 p refs
(INR-P-927) Avail: AEC Depository Libraries

Theoretical aspects of ΛN interaction are reviewed. The problem of the origin of the ΛN forces and the field theoretical derivation of ΛN potentials are discussed in great detail. The model calculations surveyed include the phenomenological potential analysis, the Brueckner–Watson two-pion exchange approach, and the one–meson–exchange model. Author (NSA)

N69-27341# Argonne National Lab., Ill.
ENDF/B NEUTRON CROSS-SECTION DATA FOR NATURAL HELIUM (ENDF–125)
E. M. Pennington 1968 33 p refs
(Contract W-31-109-eng-38)
(ANL-7462) Avail: CFSTI

The compilation of neutron cross-section data for natural helium is described. The elastic scattering cross section, $\bar{\nu}_{\gamma}$, $\bar{\epsilon}$, γ, and elastic scattering Legendre coefficients are included for ^4He. Since ^3He has a natural abundance of merely 0.00013%, only its (n,p) cross section, which is large at low energies is considered. A listing of the data in the ENDF/B format is presented, as are graphs of much of the data. Author (NSA)

N69-27345# California Univ., Livermore. Lawrence Radiation Lab.
SEARCH FOR DIRECT NEUTRON CAPTURE IN Cu 63, Co 59, and Mn 55 USING A Ge(Li) DETECTOR
George F. Auchampaugh 15 Nov. 1968 61 p refs Sponsored by AEC
(UCRL-50504) Avail: CFSTI

An 18 cc Ge(Li) detector was used to measure the intensity of 5 transitions in copper, 9 in cobalt, and 11 in manganese as a function of neutron energy. Good least square fits to some of these data were achieved if the following values of direct capture cross section at 1–eV neutron energy were included: ^{63}Cu, 2.7 ± 1.5 mb (7.914 MeV), 8.1 ± 7.6 mb (7.303 MeV); ^{59}Co, 8.8 ± 1.8 mb (7.495 MeV). In manganese no positive statement could be made about the magnitude of the direct capture cross section for the three transitions studied in detail, namely the 7.180 MeV, 7.047 MeV and 8.064 MeV transitions. All other transitions studied required no direct amplitude to fit the data. Five neutron resonances which occur in natural copper below 2 keV were

assigned to the ^{63}Cu isotope. These resonances occur at 405, 650, 807, 998 and 1368 eV. The 2.211-MeV state in ^{56}Mn was assigned $J^{\pi} = 1^{+}$. Author (NSA)

N69-27347# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

THE HARTREE-FOCK-BOGOLYUBOV EQUATIONS FOR EVEN AND UNEVEN NUCLEI AND THEIR APPLICATION IN THE MICROSCOPIC DESCRIPTION OF COLLECTIVE RADIATIONS [DIE HARTREE-FOCK-BOGOLYUBOV GLEICHUNGEN FUER GERADE UND UNGERADE KERNE UND IHRE ANWENDUNG ZUR MIKROSKOPISCHEN BESCHREIBUNG KOLLEKTIVER ROTATIONEN]

Peter Ring (Ph.D. Thesis) 1969 11 p refs In GERMAN
Avail: CFSTI

Rotation band spectra of deformed nuclei with mass numbers $A \approx 25$, $150 < A < 190$, and $A > 220$ were analyzed by using Hartree-Fock-Bogoliubov equations to describe their microstructures. Numerical calculations on these collective rotations were performed with quadrupole- and pair-correlation models to solve the rotational potential of the spectrum. Transl. by G.G.

N69-27357# Cekmece Nuclear Research Center, Istanbul (Turkey).

[CEKMECE NUCLEAR RESEARCH AND TRAINING CENTER] Progress Report, 1 Jan.–31 Dec. 1967

31 Dec. 1967 31 p
(CNAEM-49) Avail: CFSTI

Abstracted data are presented on the work being conducted in the areas of chemistry, radioisotope production, neutron physics, experimental physics, radiobiology, nuclear engineering, and health physics. The intensive training program conducted by the theoretical physics division is discussed, and the initiation of agricultural and metallurgical projects is reported. Instrumentation and operating time for the TR-1 research reactor are mentioned. Statistical data are included on air particulate activity, radioisotope production and distribution, and technical operation and services. M.G.J.

N69-27364# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

POLARIZATION EXPERIMENTS AT HIGH ENERGY

P. Sonderegger [1968] 50 p refs Presented at Intern. School of Elementary Phys., Herceg Novi, Yugoslavia, 22 Oct. 1968
(CEA-CONF-1240; CONF-681045-1) Avail: AEC Depository Libraries

Restriction is made to proper polarization phenomena, that is, those which give rise to experimentally observable asymmetries. Reactions of the type $0\ 1/2 \rightarrow 0\ 1/2$ are considered almost exclusively. A few representative experiments are analyzed in detail from the point of view of the method used and the experimental problems on one hand and the results on the other. These results are discussed in the light of the Regge pole model. NSA

N69-27365# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

MAGNETIC STRUCTURES AND PROPERTIES OF $UFeO_4$

M. Bacmann, E. F. Bertaut, A. Blaise, R. Chevalier, and G. Roult [1968] 10 p refs Presented at 14th Conf. on Magnetism and Magnetic Matter., New York, 18 Nov. 1968
(CEA-CONF-1191; CONF-681121-1) Avail: AEC Depository Libraries

Mossbauer effect studies, neutron diffraction, and magnetic measurements show that at $T_N = 55°K$, the Fe moments of the orthorhombic compound $UFeO_4$ ($a = 4.886$ Å, $b = 11.937$ Å, $c = 5.110$ Å; space group $Pbcn$–D^{14}_{2h}) order antiferromagnetically along Oy. Below $T_c = 42°K$, a non-collinear structure develops with a ferromagnetic component along Oz and an antiferromagnetic component along Ox. At 4.2°K, the moment values, determined by neutron diffraction are 4 μ_B for the ferromagnetic and 2 μ_B for the antiferromagnetic component per iron atom. There is also a measurable antiferromagnetic component of about 0.4 μ_B on the U atom. $UFeO_4$ is one of the rare examples of an oxide which is a ferromagnetic insulator. Author (NSA)

N69-27370# Oak Ridge National Lab., Tenn.

A SEARCH FOR A NEUTRON ELECTRIC DIPOLE MOMENT BY THE METHOD OF NEUTRON BEAM MAGNETIC RESONANCE

James Kern Baird (Ph.D. Thesis—Harvard Univ.) Feb. 1969 255 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2308) Avail: CFSTI

The technique and results of a neutron beam magnetic resonance experiment sensitive to a neutron EDM are reported herein. The design of the experiment is approached from the point of view of optimizing the critical parameters so as to achieve the ultimate sensitivity lying within the limitations of the available experimental methods. Among the techniques exploited is the use of a beam of ultra-slow neutrons having a characteristic velocity corresponding to a source temperature of 1°K. A careful analysis of the data for systematic errors is presented and a realistic statistical error computed. If μ_e is the EDM, and e is the charge of the proton, the experiment shows that $\mu_e = (1.85 \pm 1.14) \times 10^{-23}$ e × cm. This result rules out the possibility of parity and time reversal nonconservation in the electromagnetic interactions and suggests, but does not confirm, the existence of parity and time reversal nonconservation in the weak and/or strong interactions. Author (NSA)

N69-27381# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

RELATIVISTIC QUASIPOTENTIAL MODEL OF PARTICLE SCATTERING AT HIGH ENERGIES

V. R. Garsevanishvili, V. A. Matveev, L. A. Slepchenko, and A. N. Tavkhelidze 1969 10 p refs
(JINR-E2-4251) Avail: AEC Depository Libraries

A relativsitic model of high-energy elastic scattering is considered on the basis of the quasipotential equation in quantum field theory. The behavior of the scattering amplitude for small and large momentum transfers is investigated. Author (NSA)

N69-27382# California Univ., Berkeley. Lawrence Radiation Lab.

NOTES ON PION-PION SCATTERING, PART 1

Joel Yellin 21 Nov. 1968 46 p refs
(Contract W-7405-ENG-48)
(UCRL-18637) Avail: CFSTI

A discussion is given of $\pi\pi$ scattering covering isospin, crossing, Bose statistics, partial wave expansion, unitarity and a model for $\pi\pi$ scattering. The properties, asymptotic behavior, poles and zeros, and threshold behavior of F_0 (x,y) are discussed. Also considered are pole residues, positivity of resonance widths, behavior of $\pi\pi$ resonance widths, and angular behavior at high energies. NSA

N69-27383# Daresbury Nuclear Physics Lab. (England).

PRELIMINARY DESIGN STUDY FOR A 15 TO 20-GeV ELECTRON SYNCHROTRON: NINA BOOSTER

1968 128 p refs
(DNPL-R-2) Avail: AEC Depository Libraries

The preliminary design of a 15- to 20-GeV electron synchrotron using the 5-GeV Nina electron synchrotron as an injector is presented. A very brief account of the fields of physics open to such an accelerator and a short summary of the cost estimates are given. NSA

N69-27395# Princeton-Pennsylvania Accelerator, Princeton, N.J.
OPERATIONAL MONITORING AT THE PRINCETON-PENNSYLVANIA ACCELERATOR
W. Schimmerling and M. Awschalom 20 Jan. 1969 49 p refs
Presented at the Health Physics Society Midyear Topical Symp., Los Angeles, 29–31 Jan. 1969
(Contract AT(30-1)-2137)
(PPAD-654-E; CONF-690103-12) Avail: CFSTI

Dose rates in the external beam hall were 1–3 mrem/hr, almost entirely due to neutrons. Remanent radioactivity results are presented. A device for establishing occupancy times atuomatically is described. The results of area surveillance are used to establish personnal doses. A formula to establish occupancy times in mixed radiation fields is discussed. An extrapolation chamber was used for surface dose measurements and results are presented. A network of fixed and mobile Bonner spheres is used for neutron dosimetry. Deterioration of LiI (Eu) scintillators was observed. The correlation of neutron film badge and Bonner sphere is described in different locations. The use of multisphere techniques in film badge calibration and fading compensation is presented. Tissue-equivalent ionization chambers are used for mixed field dosimetry. ^{6}LiF and ^{7}LiF TLD pairs in the center of 2, 3, 5, 8, 10, 12, and 18 inch diameter spherical polyethylene moderators were exposed to several gamma sources and a PuBe source, all of known intensity. Results of this calibration are discussed and conversion factors presented. NSA

N69-27402# United Kingdom Atomic Energy Authority, Harwell (England).
THE BEAM TRANSPORT SYSTEM OF THE HARWELL VARIABLE ENERGY CYCLOTRON
R. W. Barnfield Sep. 1968 37 p refs
(AERE-R-5846) Avail: CFSTI; UK 7s

A description is given of the beam transport system of the Variable Energy Cyclotron. Investigations using the analog computer which furnished beam transport solutions for the initial commissioning of the beam transport system and the development of later particle beams are discussed. The design and commissioning of beam steering and scanning systems are also described. Author (NSA)

N69-27404# Joint Inst. for Nuclear Research, Dubna (USSR).
ON A MODE OF d AND He ACCELERATION IN THE JINR SYNCHROPHASOTRON UP TO 11 AND 22 GeV/c RESPECTIVELY
Yu. D. Beznogikh, L. P. Zinov'ev, G. S. Kazanskii, A. I. Mikhailov, V. I. Moroz et al 1968 26 p refs In RUSSIAN
(JINR-P9-4214) Avail: AEC Depository Libraries

Improvement of the existing accelerating systems of the JINR synchrophasotron is considered which allows one to accelerate, besides the protons, the deuterons and α-particles. The main idea of the regime suggested is to make the velocity of d- and α-particles, while passing from one accelerating system to the other, equal to half of that of protons. The acceleration of deuterons in a linear accelerator is performed at the second rate and in a proton synchrotron-in two stages, the first of which corresponds to the second rate. The first experiments performed proved the proper choice of the accelerating system had been made. Author (NSA)

N69-27405# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
MAGNETIC FIELD DESIGN FOR THE 2-METER ISOCHRONOUS CYCLOTRON OF HEAVY IONS
I. A. Shelaev, S. I. Kozlov, R. Ts. Oganesyan, and S. G. Fefilova 1968 26 p refs In RUSSIAN
(JINR-P9-4233) Avail: AEC Depository Libraries

The results are presented of the magnetic field design for the 2-meter JINR isochronous cyclotron of heavy ions. The necessary field configuration is created by means of iron masses: ring shims and the change of the sector angle length. The magnetic field formed provides stable ion acceleration in a wide range of A/Z change. The field characteristics are given in graphs. Author (NSA)

N69-27407# Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.
STUDIES OF ELECTROMAGNETIC PROPERTIES OF EXCITED STATES OF NUCLEI Annual Progress Report for 1968
F. R. Metzger 13 Dec. 1968 57 p refs
(Contract AT(30-1)-3525)
(NYO-3525-36) Avail: CFSTI

In resonance fluorescence experiments with gaseous sources, some of the limitations of the Coulomb explosion method were explored and rudimentary information concerning the velocity distribution of the fragments obtained. The differential cross section of lead for nonresonant elastic scattering of γ rays was measured with a Ge(Li) detector for angles ranging from 30 to 150° and for γ energies of 145, 279, 412, and 662 keV. Electric dipole transitions in ^{144}Nd and in ^{209}Bi were studied using the resonant scattering of bremsstrahlung from a Van de Graaff electron accelerator. Theoretical studies to interference effects between resonant and direct reactions are carried out; they apply also to the case of reactions proceeding either via an analog resonance or via compound states of lower isospin. Some features of E1 decays of nuclear octupole states were investigated and connected with the isospin properties of lower-lying 2^{+} states. Author (NSA)

N69-27414# Osaka Univ. (Japan). Lab. of Nuclear Studies.
NUCLEAR STUDIES Annual Report, Jan.–Dec. 1967
Dec. 1967 43 p
(OU-LNS-68-1) Avail: AEC Depository Libraries

The scattering of α particles by ^{23}Li, ^{40}Ar, ^{12}C, ^{24}Mg, ^{25}Mg, ^{26}Mg, and ^{16}O was investigated in order to study compound nucleus states and states in target nuclei. Angular distributions were measured for (d,α) reactions on Ar and Ne. The internal conversion electron spectrum emitted in the decay of ^{106m}Ag was observed, as were conversion electron spectra resulting from α reactions with ^{197}Au. The nuclear magnetic moments of ^{12}B and ^{12}N were also determined, and the half-life for double β decay of ^{130}Te was measured. Excitation functions for (d,p) reactions on ^{63}Cu, ^{96}Ru, ^{102}Ru, and ^{104}Ru were measured. A current integrator was developed, and design studies were carried out for a 230-cm isochronous cyclotron, including scale-model studies. An on-line data processing system was installed, and double-focusing mass spectrometers were developed. A totally depleted Si surface-barrier dE/dx detector was fabricated, and fabrication of large-volume Ge(Li) detectors was undertaken. NSA

N69-27418# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
SPECTRAL REPRESENTATIONS IN RENORMALIZED VECTOR THEORIES
B. V. Medvedev, V. P. Pavlov, and A. D. Sukhanov 1968 28 p refs In RUSSIAN; ENGLISH summary
(ITF-68-39) Avail: CFSTI

The method developed earlier for the scalar theory is applied to a successive derivation of spectral representations in renormalized vector theories. The account for the stability and unitarity conditions enables one to formulate a nontrivial solvable model whose complete sets of states involves only single-particle ones. One of the solutions of this model corresponds to the correct introducing

of field renormalization in the dispersion approach. A more general solution presents an example of the unitary and causal field theory with a nonlocal Langrangian. As a result, the complete spectral representations for vector currents and fields are obtained as well as the vacuum expectation value for the equal-time commutator of currents, and an interpretation of the appearing spectral integrals is given. The correct separation of the vector field into longitudinal and transversal parts is carried out and the canonical commutators for the Heisenberg field is obtained. Author (NSA)

N69-27443# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

SPONTANEOUS FISSION OF LEAD-SEARCH FOR VERY FAR TRANSURANIUM ELEMENTS

G. N. Flerov and V. P. Perelygin 1969 8 p refs

(JINR-D7-4205) Avail: AEC Depository Libraries

Tracks of nuclear fission fragments in Pb and its compounds were recorded by means of dielectric track detectors. For the lead glass this effect corresponds to the seemed spontaneous fission half life of Pb (2 to 3 $\times$ 10^{20} years). Various possible sources of the effect being observed are analyzed. The assumption of existence of a long-lived spontaneously fissioning transuranic nuclide may serve as one of possible interpretations of the activity being observed. Author (NSA)

N69-27447# Rome Univ. (Italy). Inst. of Physics.

ON THE INVERSE SCATTERING PROBLEM FOR DIRAC PARTICLES. EXPLICIT EXPRESSIONS FOR THE VALUES OF THE POTENTIALS AND THEIR DERIVATIVES AT THE ORIGIN IN TERMS OF THE SCATTERING AND BOUND STATE DATA

O. D. Corbella 19 Dec. 1968 56 p refs Submitted for publication Sponsored by Consejo Nacl. de Invest. Cient. y Tec., Arg. *Its* Nota Interna 199

Avail: CFSTI

The inverse scattering problem for the Dirac equation with two central potentials (one a relativistic scalar, the other the fourth component of a four vector), is investigated. Exact expressions are obtained for the values of the two potentials and their derivatives at the origin, as a function of the scattering data and bound-state parameters of the particle and the antiparticle for one angular momentum. The consideration is limited to the case of S and P waves (j = 1/2) and to potentials satisfying a restrictive condition; explicit expressions for the values of the two potentials and their first three derivatives at the origin are given. In the case with only one potential present (usual Dirac equation), these relationships provide explicit connections between the scattering and bound-state parameters for the particle and those for the antiparticle. For instance, an explicit and simple expression for the binding energy, and for the corresponding normalization constant, in terms of the scattering phase shifts of the particle and of the antiparticle, is given in the case with only one bound-state, say, for the particle present (in S or P wave, with j = 1/2). It is assumed that the two potentials are central, holomorphic, and satisfy the restrictive conditions. Author (ESRO)

N69-27451# Massachusetts Inst. of Tech., Cambridge.

NUCLEAR FORCES AND HARTREE-FOCK CALCULATIONS

A. K. Kerman Jan. 1969 98 p refs

(Contract AT(30-1)-2098)

(MIT-2098-518) Avail: CFSTI

A review of some research dealing with soft-core potentials for the nuclear force and perturbation theory based on the Hartree-Fock approximation is presented. Nuclear forces infinite nuclear matter, finite nuclei, and Hartree-Fock calculations are discussed. NSA

N69-27457# Massachusetts Inst. of Tech., Cambridge.

INCOHERENT DROPLET MODEL AND MULTIPARTICLE PRODUCTION IN ELECTRON-PROTON COLLISION

Kerson Huang Dec. 1968 10 p refs Presented at Symp. on Multiparticle Production, Argonne, Ill., 5–6 Dec. 1968

(Contract AT(30-1)-2098)

(MIT-2098-S06; CTP-56; CONF-681206-1) Avail: CFSTI

The incoherent droplet model is extended to photon-initiated reactions in particular electron–proton collisions through one-photon exchange. A model in which the proton is soft and one in which the proton is hard are described. NSA

N69-27464# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

VISUAL FUNCTION GENERATORS IN CONJUNCTION WITH A HYBRID SYSTEM [GENERATEURS DE FONCTIONS VISUELLES EN LIAISON AVEC UN SYSTEME HYBRIDE]

A. Neyron [1968] 15 p refs In FRENCH; ENGLISH summary Presented at the Intern. Symp. on Nucl. Electron., Versailles, France, 10 Sep. 1968

(CEA-CONF-1149; CONF-680906-13) Avail: AEC Depository Libraries

The specific needs in nuclear physics are reviewed: logarithmic plotting of spectra, isometric display, substraction of gaussian curves or even more simply the decimal display of lists of numbers. When taking into account technical requirements (working speed, etc.) one is naturally led to the generation of these functions by hardware. The so augmented display system has widened capabilities and versatility. By the association of a hybrid device having both a working station and a display station (polychromic display of 1.5 $\times$ 10^5 dots) the flicker effect is reduced whereas the conveniences for a versatile dialogue are preserved. Author (NSA)

N69-27465# Texas Univ., Austin. Center for Nuclear Studies.

ISOSPIN MIXING AND THE CHARGE EXCHANGE INTERACTION IN (d,p) REACTIONS ON Zr-90, Zr-91, and Zr-92

R. G. Clarkson, W. R. Coker, T. A. Griffy and C. F. Moore Oct. 1968 242 p refs

(Contract AT(40-1)-2972)

(ORO-2972-86; TR-4) Avail: CFSTI

Angular distributions and excitation functions for (d,p) reactions on ^{90}Zr, ^{91}Zr, and ^{92}Zr were measured at deuteron energies of 4 to 11 MeV. Deuteron and proton elastic scattering angular distributions were also measured in order to obtain optical model parameters for the DWBA analysis of the (d,p) data. Spectroscopic factors were determined from the DWBA analysis, and 1-value assignments were made or confirmed for a number of states. In addition, the effects of mixing of T = 1 states in the deuteron, arising from the Coulomb field of the nucleus, were calculated for (d,p) stripping reactions. A computer program was written to calculate this mixing, to second order in the Born approximation, using plane-wave stripping theory and the dipole approximation for the Coulomb field. The admixture calculated in these approximations was found to be appreciable for typical cases in medium-weight nuclei. NSA

N69-27478# Sandia Corp., Albuquerque, N.Mex.

ON SOME PECULIARITIES OF THE TRANSFER OF ROTATIONAL AND VIBRATIONAL ENERGIES IN PROCESSES OF ION-MOLECULAR COLLISIONS

G. N. Polyakova et al [1968] 17 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 54, 1968 p 374–383

(SC-T-69-1007) Avail: CFSTI

A study was made of the distribution of N^+_2 ions in an excited state $B^2\Sigma^+_u$ originating in collisions of ions He^+, Li^+, Ne^+, Na^+, Ar^+, and K^+ with N_2 molecules by the rotational and vibrational energy levels. To this end measurements are made of the distribution of rotational line intensities in the band λ = 4278 Å of the first negative system of the ion N^+_2 ($1\ NGN^+_2$) and the ratio of intensities of the bands λ = 4236 Å and λ = 4278 Å of the same system. A comparison of the distribution of the ions N^+_2 ($B^2\Sigma^+_u$) by the rotational and vibrational energy levels with a corresponding distribution of the initial molecules of N_2 warrants the conclusion that in all investigated cases the production of the N^+_2 ($B^2\Sigma^+_u$) ion in collisions of ions with N_2 molecules is accompanied by the transfer to this ion of rotational and vibrational energies. Author (NSA)

N69-27501# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.

NaI SPECTROMETER MEASUREMENT OF THICK-TARGET BREMSSTRAHLUNG AT ELECTRON ENERGIES ABOVE 5 MeV

C. W. Sandifer and M. Taherzadeh Jul. 1968 34 p refs
(Contract AT(29-1)-1183)
(EGG-1183-2179; S-417-R) Avail: CFSTI

Thick-target bremsstrahlung spectra produced by electron bombardment of a 0.2 radiation length gold-tungsten target were measured for electron energies in the range of 5.3 to 20.9 MeV. A large NaI spectrometer coupled to a pulse pile-up rejection system measured pulse-height distributions for bremsstrahlung emitted in the forward (zero-degree) direction, and a response matrix developed for the spectrometer was used to convert pulse-height distributions into photon energy spectra. The shapes of the measured spectra show good agreement with those obtained by others for the same target configuration. Apparatus and experimental methods are described, and thick-target bremsstrahlung spectra are presented for electron energies of 5.3, 10.0, 14.8, 16.4, 18.2 and 20.9 MeV. Author (NSA)

N69-27521# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

SPIN INTERACTIONS BETWEEN SLOW ELECTRONS AND AMINO ACID FILMS Progress Report, 1 Jun. 1968–28 Feb. 1969

Edward Yeargers 1 Mar. 1969 6 p refs
(Contract AT(40-1)-3799)
(ORO-3799-1; PR-1) Avail: CFSTI

The status of a research program on the nature of the excited states produced by slow electrons incident on amino acid films is described. The program was begun in June 1968; since that time the design and construction of the experimental apparatus has been almost completed and a set of semiempirical, self consistent field calculations have been made for tryptophan. The latter calculations were made to determine the locations of the singlet and triplet levels which subsequently will be investigated with the newly constructed experimental apparatus. In addition to energy level calculations, charge densities, bond lengths, and static and transition dipole moment magnitudes and directions were computed for the various transitions. A quantum mechanical description of the interaction between the spin of an incident electron and the orbital motion of an atomic electron was begun. Author (NSA)

N69-27527# Oak Ridge National Lab., Tenn.

LOW ENERGY ELECTRON BEAM STUDIES IN THIN METAL FILMS

F. W. Garber (Ph.D. Thesis—Tenn. Univ.) Feb. 1969 130 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2406) Avail: CFSTI

An experimental investigation is reported of the interactions of low-energy electrons in thin metal foils of aluminum and sodium. The target system consisted of a thin metal top foil, an anodically produced Al_2O_3 layer of 75 Å, and a bottom aluminum foil approximately 2000-Å thick, all supported by a glass substrate. Transmission of the top metal foil was determined by measuring the electron currents in both metal foils while the system underwent monoenergetic electron irradiation. Data are presented for top foils vacuum-evaporated under ultrahigh vacuum and high vacuum. In all cases the top foil was not exposed to the atmosphere prior to data taking. The electron beam was normally incident upon the target system. A Monte Carlo code using theoretical inverse mean-free-path calculations is also described and was used to generate data analogous to the experimentally measured transmission curves. Author (NSA)

N69-27543# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.

NEUTRON COUNTING EFFICIENCY AND CHARGED PARTICLE RESPONSE OF AN NE-213 FLUOR DETECTOR

A. A. O'Dell, C. W. Sandifer, and R. B. Knowlen 22 Jan. 1968 35 p refs
(EGG-1183-2172; S-413-R) Avail: CFSTI

The absolute neutron-detection efficiency and charged-particle response of an NE-213 scintillation detector for neutron energies ranging from 0.2 to 20 MeV were measured. Neutron fluence was measured with a fission chamber and with a long counter, both of which were calibrated with a proton-recoil telescope. Neutron detection efficiency was measured for detector bias levels corresponding to electron energies of 14 ± 4 and 31 ± 1 keV, as determined by observation of Compton pulse-height spectra from monoenergetic gamma-ray sources. The agreement between the measured efficiency data and calculations based on a single-collision model considering (n,p), $^{12}C(n,n)$, and $^{12}C(n,\alpha)$ reactions is within the estimated experimental error of ±8%. Analysis of the Compton pulse-height spectra shows that NE-213 has a linear response to electrons with energies greater than approximately 150 keV, and that the pulse height at the high-energy half-intensity point of the Compton distribution is equivalent to 1.05 ± 0.01 times the Compton edge energy. Measured proton response values for NE-213 are in good agreement with previously reported measurements above 3 MeV; however, for lower proton energies, disagreement on the order of 30% is observed. Author (NSA)

N69-27553# Rice Univ., Houston, Tex.

ON NUCLEAR PHYSICS Progress Report

1968 21 p refs (Contract AT(40-1)-1316)
(ORO-1316-70) Avail: CFSTI

Developments in the neutron physics program, three body breakup reaction studies, charged particle reaction studies, polarization studies using polarized ^3He targets, nuclear theory, and instrumentation are reported. Author (NSA)

N69-27594# Rochester Univ., N.Y. Nuclear Structure Research Lab.

THE N SUP 15 (He SUP 3,d) O SUP 15 REACTION AND THE STRUCTURE OF OXYGEN 15

H. W. Fulbright, J. A. Robbins, M. Blann, D. G. Fleming and H. S. Plendl (Fla. State Univ.) Mar. 1969 48 p refs Sponsored in part by NSF and AEC
(UR-NSRL-12) Avail: Issuing Activity

The structure of O^{15} was studied by means of the $N^{15}(He^3,d)O^{15}$ reaction. The experiments were performed with 18.00 and 24.90 MeV He^3 beams from the tandem Van de Graaff accelerator at Rochester. Reaction products were analyzed and recorded automatically by means of a high-resolution magnetic

spectrometer equipped with a sonic spark counter connected to an on-line computer system. In the region of excitation up to about 22 MeV, 14 lines have been identified with levels of O^{16}, all having odd parity except the ground state, which was strongly excited, the first excited state, which was weakly excited, and the third excited state, which was barely detectable. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-26237*# Aztec School of Languages, Inc., Maynard, Mass.
PULSED THERMONUCLEAR SYSTEM WITH DENSE PLASMA
S. G. Alikhanov et al Washington NASA May 1969 9 p refs Transl. into ENGLISH of the publ. "Impul'snaya Termoyadernaya Sistema s Plotnoy Plazmoy" Novosibirsk, Akad. Nauk SSSR, Inst. Yadernoy Fiz., 1967 p 1–13
(Contract NASw-1692)
(NASA-TT-F-12236) Avail: CFSTI CSCL 20I

This article examines the closed system, which is favorable for adiabatic compression of a dense plasma by way of deformation of the container. It is shown that the system attains equilibrium and magnetohydrodynamic stability during the requisite time. An adequate compression rate and a short operating time make it possible to neglect the comparatively slow loss in plasma due to diffusion. Author

N69-26241# Joint Publications Research Service, Washington, D.C.
SOVIET STUDIES ON MAGNETOHYDRODYNAMIC GENERATORS
A. T. Rakhimov et al 14 May 1969 41 p refs Transl. of the book "Electricity from MHD, Vol. 1" 1966 p 333–341; p 465–472
(JPRS-48041) Avail: CFSTI

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1. MAGNETIC HYDRODYNAMICS OF FLOW IN MHD DUCTS A. T. Rakhimov et al p 1–11 refs (See N69-26242 14-25)

2. CALCULATION OF THE BOUNDARY LAYER AT THE ELECTRODE OF A PLANE MHD GENERATOR A. Ye. Yakubenko p 12–21 refs (See N69-26243 14-12)

N69-26242# Joint Publications Research Service, Washington, D.C.
MAGNETIC HYDRODYNAMICS OF FLOW IN MHD DUCTS
A. T. Rakhimov et al *In its* Soviet Studies on Magnetohydrodynamic Generators 14 May 1969 p 1–11 refs (See N69-26241 14-25)
Avail: CFSTI

Problems are discussed of the magnetic hydrodynamics of flows with hot electrons in MHD ducts at low magnetic Reynolds numbers. In connection with boundary layer theory, conditions of the occurrence of detachment and the jump in density associated with it are discussed for a supersonic flow. Methods of preventing detachment are discussed; in particular the required degree of exhaustion of the plasma from the boundary layer is calculated. Attention is also given to wave resistance to a supersonic flow which arises from the uneven distribution of the current on the electrode wall of the duct. In connection with the theory of shock waves in a plasma with hot electrons, the structure of these waves in relation to ionization is considered, together with their stability. Problems related to the appearance of parasitic closed currents, with a strong reduction in conductivity of the plasma beyond the shock-wave front and a change in the mode to accelerating, are also dealt with. Author

N69-26313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CIRCULATING CURRENTS IN LINEAR CROSSED-FIELD GENERATORS AND ACCELERATORS
Gustav A. Carlson Washington May 1969 14 p refs
(129-02-08-01-00-21)
(NASA-TN-D-5244) Avail: CFSTI CSCL 20I

Boundary layers on the walls of linear crossed-field plasma generators and accelerators cause circulating electrical currents that can greatly affect the operation of these devices. Expressions are derived for the velocity and current distributions in the open circuit device from the analysis for fully developed incompressible magnetohydrodynamic (MHD) flow in a square duct with nonconducting walls. From these distributions the viscous and ohmic heat generation rates in the working fluid were calculated for Hartmann numbers up to 24, where the magnetic force is dominant. Measured heat-transfer rates to the walls of an open circuit J x B plasma accelerator were found to increase with applied magnetic field strength at the insulator walls but to remain nearly constant at the electrode walls. A comparison of theory and experiment indicates that the calculated heat generation has both the magnitude and spatial distribution to explain the observed heat-transfer rates. The circulating currents significantly decelerate the flow near the center of the duct, and will exist in any MHD duct in which there is an appreciable boundary layer and a large conductivity extending to near the walls. Author

N69-26400# Minnesota Univ., Minneapolis. Inst. of Tech.
INVESTIGATIONS OF IONIC SPECIES IN HIGH PRESSURE CESIUM DISCHARGES Annual Report, 1 Mar. 1968–28 Feb. 1969
L. M. Chanin 28 Feb. 1969 32 p refs
(Contract N00014-67-A-0113)
(AD-683685; AR-3) Avail: CFSTI CSCL 20/9

Measurements are reported of the ionic species present in active discharges of argon and cesium. The discharges were created using rf and dc excitation. A simple plasma model is used to account for the observed ion current signals. Author (TAB)

N69-26425# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron. and Plasma Physics.
REPORTS FROM THE DIVISIONS OF ELECTRON- AND PLASMA PHYSICS: INDEX AND ABSTRACTS 1968
30 Jan. 1969 14 p refs
(Rept-68-35) Avail: CFSTI

Index and abstracts of reports published by the divisions of electron and plasma physics of the Royal Institute of Technology, Stockholm in 1968 are presented. ESRO

N69-26482# Aeronautical Research Council (Gt. Brit.)
NUMERICAL CALCULATIONS OF THE PROPERTIES OF AXIALLY SYMMETRIC ARC COLUMNS
A. Wells 1969 32 p refs Supersedes RAE-TR-67076; ARC-29301; See N68-13173
(ARC-R/M-3580; RAE-TR-67076; ARC-29301) Copyright. Avail: CFSTI; HMSO 15s

Numerical solutions of the energy-balance equation of an axially symmetrical uniform arc column are outlined and illustrated with results pertaining to a nitrogen plasma at atmospheric pressure. Published data on the electrical conductivity, thermal conductivity and radiated power density of nitrogen plasmas have been reviewed.

The data selected for subsequent calculations of arc properties are summarised and reasons for selecting these are discussed. Using the selected data, temperature distributions [T(r)], arc radii (R), arc currents (I) and radiation losses (U), are calculated for arc columns in which the axial temperature, T_0, and the voltage gradient, E, have been specified. Results are summarised by a series of graphical plots of arc similarity parameters I/ER^2, U/R^2, $EI-U$, against the axial temperature, T_0. The purpose of the calculations is to provide data for comparison with experimental measurements on magnetically propelled arcs. Author (ESRO)

N69-26544# Aktiebolaget Atomenergi, Studsvik (Sweden).
FORMATION OF NEGATIVE METAL IONS IN A FIELD-FREE PLASMA
Egon Larsson Feb. 1969 32 p refs Submitted for publication
(AE-350) Avail: CFSTI

A field-free and homogeneous plasma of a large volume is formed by neutron irradiation of ^3He at a density coressponding to NTP and at gas temperatures in the range 300-1600°K. The accuracy and ease by which the source density of free electrons can be varied and controlled offers special possibilities to study recombination and attachment phenomena in the absence of diffusion. These possibilities are described and utilized for the study of the effects of mixing the helium gas with metal vapors. Attachment of electrons to neutral metal atoms is found to be the dominant cause of electron removal for metal concentrations above certain limits. Negative metal ions are formed and the rate of their formation was determined to be about 10^{-13} $cm^3 s^{-1}$. Evidence is also presented that for such conditions where formation of negative metal ions does not occur, the electrons are lost in electron-ion recombinations, in which the third body is not an electron. No molecular helium spectrum is observed from the plasma when it is very close to spectroscopic purity. Instead, between 3000-7000 Å only one atomic helium line at 5875 Å is observed. The recombination of He^+_2 may therefore be dissociative. A difference in recombination behavior between ^3He and ^4He at high pressures may therefore exist considering results from previous work on ^4He. Author (ESRO)

N69-26548 Iowa Univ., Iowa City
ION-ACOUSTIC WAVES IN A COLLISION-DOMINATED MERCURY-VAPOR PLASMA
Suthi Aksornkitti (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16772

The experiments are an extension of previous work concerning a collision-dominated plasma. Theoretically, a fluid model analysis for such a plasma is carried out. The following are observed and identified: 1) an anisotropic nature of wave propagation in a spherical discharge tube which can be related to ambipolar diffusion; 2) a dispersive region of the ion waves beneath the ion-neutral collision frequency; 3) a reflection of ion waves in a perturbed plasma; 4) pseudo-ion waves which behave like bursts of accelerated ion from a grid exciter; 5) stationary striations in a cylindrical discharge tube. It is also suggested that the ion-acoustic waves can be useful for basic gas discharge diagnostics. Numbers are obtained for the ion-neutral collision frequency and the ambipolar diffusion coefficient, checked by independent methods, and found to agree with those in the literature. Dissert. Abstr.

N69-26554 Cornell Univ., Ithaca, Ithaca, N.Y.
A STUDY OF LASER GENERATED PLASMAS AND THEIR APPLICATION TO HIGH POWER MICROWAVE SWITCHING
David Michael Stevenson (Ph.D. Thesis) 1968 208 p
Avail: Univ. Microfilms HC $9.45/Microfilm $3.00 Order No. 68-15738

The production and properties of dense, rapidly expanding carbon plasmas, generated in vacuum by irradiating graphite surfaces with the focused beam of a Q-switched ruby laser giving 6 Mw of peak power in a 25 ns pulse are presented. The microwave properties of plasmas generated from a target at the center of the broad face of X-band wave guide were studied. Microwave diagnostics with RF powers of less than 0.1 w and plate current measurements showed that the plasma expands across the guide in about 0.1 μs. Microwave switching experiments using RF powers up to 50 kw showed that due to nonlinear interaction between the plasma and RF strong absorption of the RF power by the plasma can occur. A gas dynamic model for the plasma expansion is analysed. A preliminary investigation of the possibility of using photoionization of a filler gas to detect and measure the vacuum uv radiation from the laser generated plasma using microwave techniques was made. Dissert. Abstr.

N69-26642# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
RESEARCH PROJECTS OF THE AEROSPACE CORPORATION PLASMA RESEARCH LABORATORY, 1961-1968
Jan. 1969 95 p refs
(ATR-69(9990)-1) Avail: Issuing Activity

Short descriptions are presented of research projects in those areas of plasma physics that are relevant to current and future Air Force requirements. The investigations are in the categories of reentry communications, plasma diagnostics, exploratory studies in plasma applications, magnetohydrodynamics, and theoretical plasma physics. A selected list of papers and reports published from 1961 to mid-1968 is appended. Author

N69-26665# Texas Univ., Austin. Plasma Physics Lab.
BASIC STUDIES REGARDING LINE BROADENING Final Report, 1 Jun. 1966–31 May 1968
Hans Schlueter Wright-Patterson AFB, Ohio AFL Oct. 1968 46 p refs
(Contract AF 33(615)-5116)
(AD-683353; ARL-68-0196) Avail: CFSTI CSCL 20/9

The ratio of halfwidth to critical value for the transition between quasi-static and impact domain of electron contributions to linear Stark broadening (according to Unsold) is expected to vary approximately with n to the 4th power, where n is the upper principle quantum number of the line considered. Low density plasmas generated by a radio frequency arrangement permit the observation of many non-overlapping Balmer lines and thus a drastic variation of the ratio; for identical plasma parameters access deep into the quasi-static as well as impact regime of electron broadening is realized to a degree not achieved previously. As recently suggested, the observed broadening can be approximated in terms of an effective quasi-static perturber density, which is a universal function of the displacement from the line center expressed in units of the above mentioned critical transition value. Author (TAB)

N69-26689# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
GROWTH RATE OF INSTABILITIES IN STRATIFIED PLASMAS
F. Hernegger 30 Dec. 1968 15 p refs
(Contract F61052-67-C-0014)
(AD-683352; UNICP-SR63; SR-63; AFOSR-69-0370-TR) Avail: CFSTI CSCL 20/9

The purpose of the paper is to investigate effects of a discontinuous, inhomogeneous magnetic field and gravitational effects on the growth rate of Kelvin-Helmholtz instabilities in inhomogeneous plasmas within the framework of ideal MGD. It is shown that an increasing nonuniform magnetic field with a sole component in the direction of the flow has a destabilizing effect as soon as a critical magnetic field is reached. Author (TAB)

N69-26756# Israel Program for Scientific Translations, Ltd., Jerusalem.

PENETRATION OF A LONGITUDINAL ELECTRIC FIELD INTO A BOUNDED MAGNETOACTIVE PLASMA

A. N. Kondratenko *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 380–390 refs (See N69-26751 14-23)

Copyright. Avail: CFSTI

The penetration of a longitudinal field into a bounded layer of plasma immersed in a constant homogeneous magnetic field H_0 parallel to the plasma boundary is considered. The plasma layer of r l804 l52 w20. l52 w20. 0 a is assumed to be homogeneous. The coordinates are so chosen that the x axis is perpendicular to the plasma boundaries (x = o and x = a), and the z axis points along H_0. Assuming all quantities to be proportional to exp(−iωt), equations are derived for the amplitudes using Maxwell equations and the continuity equation for the field in the plasma. Author

N69-26792# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE FAST IONS ARISING IN THE INTERACTION OF RUNAWAY ELECTRONS WITH A PLASMA

E. A. Sukhomlin et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 509-511 refs (See N69-26751 14-23)

Copyright. Avail: CFSTI

A study is outlined which investigated the fast ions arising during the excitation of instabilities by runaway electrons in a high current linear gas discharge stabilized by a strong magnetic field (of up to 15 kOe). The stream of emerging particles was studied in both the transversal and the longitudinal direction (relative to the external magnetic field). It was established that, with the onset of instability, ionic current pulses are observed when the runaway electron current is cut off, in the form of a single short duration pulse. Oscillograms of the total discharge current of 1 keV ions emerging along the magnetic field are presented. A characteristic feature of fast ion generation is the threshold-type dependence on the electric field strength in the plasma; this dependence is shown in graphical form for a longitudinal ionic current. P.A.B.

N69-26896# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Gas Ionizzati.

DRIFT WAVES IN A SLIGHTLY NON-NEUTRAL PLASMA

A. Nocentini Dec. 1968 31 p refs Prepared jointly with EURATOM and Trieste Univ.

(LGI-68/29) Avail: CFSTI

The influence of the lack of neutrality on the drift instabilities (collisionless and collisional) of a non-uniform, isothermal plasma is considered. It is shown that the local dispersion relation depends on the derivatives of the electric field present, in the equilibrium of the non-neutral plasma. In particular the influence of the first two derivatives is discussed. Author (ESRO)

N69-26907# Israel Program For Scientific Translations, Ltd., Jerusalem.

QUASILINEAR THEORY OF OSCILLATIONS IN MAGNETOACTIVE PLASMA

V. L. Sizonenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 535–544 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

The fundamental equations of the quasilinear theory of oscillations in a homogeneous plasma without external magnetic fields were derived by averaging the distribution function of resonance particles, which satisfies Vlasov's equation with a self-consistent field. The initial perturbation of the oscillating part of the distribution function has been neglected and only those electromagnetic waves were considered for which the Hermetian part of the plasma permittivity tensor was greater than the corresponding anti-Hermetian part. Derived were equations of the phonon distribution function and field amplitudes for the case of strong spatial dispersion. G.G.

N69-26932# Israel Program for Scientific Translations, Ltd., Jerusalem.

DRIFT INSTABILITY IN A PLASMA IN A STELLARATOR HELICAL MAGNETIC FIELD

V. F. Aleksin et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 688–690 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

The drift waves in a plasma in a stellarator helical magnetic field are investigated theoretically. The dispersion equation for drift waves is derived; and localized disturbances with wavelengths markedly greater than the difference between the largest and the smallest radius of the magnetic surface are considered. It is concluded that the stellarator helical magnetic field can be regarded as an axisymmetric field with lines of force coinciding with the averaged stellarator lines of force. Conditions for stability of highly localized disturbances are given and an equation for the drift-wave stability condition is presented. K.R.G.

N69-27014# Atomic Energy Commission, Washington, D.C.

HOT PLASMA PRODUCTION DURING INJECTION OF CLUSTERS OF FAST ATOMS INTO MAGNETIC TRAPS

K. B. Kartashev et al [1969] 24 p refs Transl. into ENGLISH from Russian Rept. IAE-1399

(AEC-tr-7016; IAE-1399) Avail: CFSTI

Descriptions are given of a new method for producing hot plasma in magnetic traps by injection of dense fast atom clusters. The capture of atoms is achieved either by the incoming cluster or by short-life plasma targets. Author (NSA)

N69-27028# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

INTERACTION BETWEEN ION FLUX AND TARGET PLASMA DURING CHARGE EXCHANGE

K. B. Kartashev, V. I. Pistunovich, and E. A. Filimonova 1967 24 p refs Transl. into ENGLISH of the Russian Rept. IAE-1400

(AEC-tr-7017; IAE-1400) Avail: CFSTI

The interaction between a homogeneous plasma in the absence of a magnetic field and an ion flux in which the ion temperatures differ in the transverse $T_\perp$ and longitudinal $T_\parallel$ directions with respect to the directional velocity u of ions is considered. The effect of the temperature anisotropy of the ion flux on the stability of oblique waves in plasma is elucidated and a comparison with the previously considered cases of isotropic distribution is presented. NSA

N69-27054 Texas Univ., Austin.

SPACE-TIME RESOLVED MACH-ZEHNDER INTERFEROMETER MEASUREMENTS OF CROSS-SECTIONAL ELECTRON DISTRIBUTION IN THETA-PINCH PLASMA

Howard Nixon Roberts (Ph.D. Thesis) 1968 139 p

Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-16128

In theta-pinch deuterium plasmas end-losses, instabilities, axial density minima, neutron production, and plasma luminosity are investigated and correlated for 0.005 to 0.10 Torr, +4.0 to −4.0 kG bias B-field, and 17 to 55 kG peak B-field. For 0.04 to 0.10 Torr a Mach-Zehnder interferometer illuminated by a 175 MW(6943 Å) giant pulse ruby laser and axially coupled to the plasma yields space-time resolved cross-sectional electron distributions. The cold gas in the 20.63 cm long one-turn coil region inside the 5.08

cm ID quartz vacuum chamber is ≈99 per cent preionized and preheated to ≈2 eV, subjected to an axial bias B-field, and compressed by strong axial B-fields which reach their peak values in 3.4 μsec (at t= 3.4 μsec). A digital computer technique employs information extracted from the interference fringe patterns to determine the total number of electrons N_e present.
Dissert. Abstr.

N69-27055 Carnegie-Mellon Univ., Pittsburgh, Pa.
ELECTRICAL CHARACTERISTICS OF A LOW PRESSURE SLEPIAN DISCHARGE ROTATING MAGNETOPLASMA WITH A PENNING DISCHARGE RADIAL ION SOURCE
Richard Anthony Rikoski (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17640

The low pressure discharge rotating magnetoplasma has been investigated in helium for neutral gas pressures of 3.3×10^{-1} and 6.7×10^{-2} torr with applied end wall potentials to +300 volts d.c. and an applied axial magnetic field of 0 to 6000 gauss. A Penning discharge radial ion source with cold cathodes and cathode-anode current capability of 500 ma is incorporated as a central ion source within the Slepian discharge apparatus. Electrical characteristics for the ionizer have been measured for pressures of 10, 5, 1, 10^{-1}, $10^{-2}$and 10^{-3} torr. Terminal electrode characteristics have been measured in the Slepian discharge including radial and axial currents as functions of a variety of discharge electrical and physical parameters. For pressures of $3.3 \times 10^{-1}$and 6.7×10^{-2} torr, anomalous diffusion effects were not observed. End current minima five times as great as those previously observed have been found in the low pressure Slepian discharge. Thus it has been concluded that a high degree of thermal enhancement is present in this discharge.
Dissert. Abstr.

N69-27109# California Univ., Livermore. Lawrence Radiation Lab.
RESONANCE PHENOMENA IN PLASMA AND FLUID FLOWS
A. V. Timofeev Dec. 1968 195 p refs Transl. into ENGLISH from Russian booklet Sponsored by AEC
(UCRL-Trans-10323) Avail: CFSTI

It is found that the stability and the oscillatory properties of flows in a continuous medium (plasma or ordinary fluid) are determined by phenomena which develop at resonance points at which the phase velocity of the wave is equal to the flow velocity. It is found that all the undamped proper oscillations are absent from the simplest plasma flows with sufficiently rapidly varying velocity profiles. In the theory of plane-parallel flows of an incompressible fluid, the analogous result is given by Rayleigh's theorem.
Author (NSA)

N69-27151# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
NONLINEAR THEORY OF ION ACOUSTIC WAVES WITH LANDAU DAMPING
E. Ott and R. N. Sudan Apr. 1969 29 p
(Grants NSF GK-4769; NSF GA-989)
(LPS-10) Avail: Issuing Activity

The macroscopic equation governing the time development of a nonlinear ion acoustic wave is presented. The equation takes into account the normalized wave amplitude, space and time coordinates, and parameters which depend on the relative strengths of Landau damping, nonlinearity, and dispersion. The first three terms constitute the Korteweg-deVries equation, and the last term represents the effect of Landau damping. The equation conserves the number of particles, but the wave energy can be shown to decay always. It is demonstrated that an initial waveform may either steepen or not, depending on the relative size of the nonlinearity as compared to Landau damping. Qualitative check is made with ion acoustic shock wave experiments reported in the literature. It is also shown that the Landau damping term causes the amplitude of a solitary wave to decay with time.
Author

N69-27191# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-CURRENT PLASMA ACCELERATOR WITH CLOSED ELECTRON DRIFT
A. I. Morozov et al 13 Nov. 1968 10 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 7, no. 7, 1968 p 224–227
(AD-683997; FTD-MT-24-384-68) Avail: CFSTI CSCL 20/9

The authors have developed and tested a high-current plasma accelerator with closed drift, embodying electrostatic and magnetic focusing, and using hydrogen as the working gas.
Author (TAB)

N69-27206# Atomic Energy Commission, Washington, D.C.
INVESTIGATION OF THE MECHANISMS OF PLASMA JET CUTOFF BY TRANSVERSE MAGNETIC FIELDS
E. Ya. Golts et al [1969] 34 p refs Transl. into ENGLISH from Russian Rept. NP-17581
(AEC-tr-7015; NP-17581) Avail: CFSTI

Physical processes in producing short hydrogen plasma clusters by the cutoff part of plasma jets were investigated. A special device was constructed for determining the longitudinal and transverse polarization of plasma and capture and reflection by magnetic fields. The design and performance of the device are described and probe descriptions are given of reflection, capture, and penetration of plasma through the device gate. Measurement of angles of deflection of ions passing through the gate is discussed.
NSA

N69-27214# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SPECTRAL MEASUREMENTS OF PLASMA TEMPERATURE IN THE RPI INJECTOR
Szymon Suckewer 1968 39 p refs
(INR-P-948) Avail: AEC Depository Libraries

The results of ion and electron temperature measurements for the focusing injector are shown in terms of initial conditions. The ion temperature measurements made with plasma being observed lengthwise and perpendicularly to the gun axis, thereby eliminating the correlated axial motion of plasma from the results. It was observed that T_i increases with a rise in ion charge, whereas increasing the initial gas pressure in the discharge tube decreases T_i. The ion temperature drop is also observed when applying an external magnetic field of 5 kG. The highest values of $T_i \approx 1.5 \times 10^6$°K are defined for the air initial pressure of 10^{-4} torr, and the maximum electron temperatures T_e do not exceed ≈ 5×10^4°K. The distribution of plasma ion and electron temperatures are determined as a function of distance from the gun axis. The considerable differences observed between the electron and the ion temperatures are also discussed.
Author (NSA)

N69-27283# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ION CYCLOTRON INSTABILITY IN THE MAGNETIC WELLS OF DECA-2 [INSTABILITE CYCLOTRONIQUE IONIQUE DANS LE PUITS MAGNETIQUE DE DECA 2]
P. Brossier, P. Lecouetey, C. Renaud, and J. Tachon [1969] 13 p refs In FRENCH; ENGLISH Summary Presented at 3d Intern. Conf. on Controlled Plasma Phys., Novosibirsk, USSR, 1 Aug. 1968
(CEA-CONF-1004; CN-24/H-7; CONF-680808-28) Avail: AEC Depository Libraries

The results of the study of the ion cyclotron oscillations observed in the quadrupolar magnetic well of DECA-II are reported. The experimental results are compared with the theoretical results of a model taking into consideration the density gradient, the distribution function of the hot ions, and the presence of a cold Maxwellian plasma. The experimental results showed that cold plasma can have a destabilizing role for hot plasmas having a loss cone distribution function. Author (NSA)

N69-27285# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PECULIARITIES OF THE WORKING OF LOW TEMPERATURE PLASMA GENERATORS WITH VORTICAL ARC STABILIZATION AND GENERALIZATION OF INVESTIGATIONS

G. Yu. Dautov et al 21 Feb. 1968 18 p refs Transl. into ENGLISH from Mezhdunarodnykh Simpozium po Svoistvam i Primeneniyu Nizkotemperaturnoi Plasmy. Mezhdunarodnom Kongresse po Teoreticheskoi i Prikl. Khim. 20th (Moscow), 1965 p 1–19

(AD-683198; FTD-HT-23-1292-67) Avail: CFSTI CSCL 20/9

Some results of studying the electric arc burning processes such as (1) shunting affecting the arc average length, (2) large and reduced scale fluctuations of voltage, current and arc length causing the instability and affecting the electrodes life-time in a vortex stabilized arc plasma generator are presented. Conditions for the achieving of the increasing current voltage characteristics are indicated. The effect of the polarity of electrodes on the arc current voltage is explained. Some criteria for the description of the plasma generator characteristics and results of the criterial generalization are given. It is shown that the criterial generalization can be extended to a-c plasma generators. TAB

N69-27309# Sydney Univ. (Australia). School of Physics.

PLASMA HEATING FROM NONLINEAR EFFECTS OF LARGE AMPLITUDE ALFVEN WAVES

C. N. Watson-Munro, R. C. Cross, and B. W. James Sep. 1968 24 p refs

(NP-17781) Avail: AEC Depository Libraries

In a cylindrical highly ionized hydrogenous laboratory plasma source, the propagation of Alfven torsional waves of azimuthal wave field b_θ propagating parallel to a steady magnetic field B_0 inthe z direction was studied. The situation was studied up to perturbation ratios b_θ/B_0 of 7.4 and Alfven Mach Numbers M_A up to 3. It was found that up to a perturbation ratio of about 1.3 theoretical predictions from MHD shock wave theory of shock velocity, density and temperature behind the shock are experimentally realized. Above this perturbation ratio, theory and experiment depart; marked attenuation of the Alfven wave occurs and large amplitude oscillations develop. Author (NSA)

N69-27308# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes Nucleaires.

USE OF A MONTE-CARLO METHOD FOR STUDYING THE STATISTICAL DISTRIBUTION OF ELECTRIC FIELDS AROUND AN ION IN A ONE-COMPONENT PLASMA [ETUDE, PAR UNE METHODE DE MONTE CARLO DE LA REPARTITION STATISTIQUE DES CHAMPS ELECTRIQUES AU NIVEAU D'UN ION, DANS UN PLASMA A UNE COMPOSANTE]

Daniel Rossignol-Guza (Ph. D. Thesis - Paris Univ.) Nov. 1968 104 p refs

(CEA-R-3615) Avail: AEC Depository Libraries

A Monte Carlo simulation has been made of the equilibrium configurations taken by a plasma of equally charged prompt ions, immersed in a uniform neutralizing background of electrons. The statistical repartition of the electric field acting on one ion, needed to obtain the Stark effect, was specially obtained. Comparison for dense plasmas was made with the former works of Holtzmark, Mayer, and Broyles. Author (NSA)

N69-27319# Stanford Univ., Calif. Inst. for Plasma Research.

TRANSPORT PROPERTIES OF TWO-TEMPERATURE PARTIALLY IONIZED PLASMAS

Umur Daybelge Dec. 1960 155 p refs

(Contract F44620-68-C-0051)

(AD-683347; SU-IPR-263; AFOSR-69-0382-TR) Avail: CFSTI CSCL 20/9

A simplification of the Chapman-Enskog method for the calculation of transport properties of two-temperature, partially ionized gas mixtures in a magnetic field is presented. The simplification is achieved by exploiting the fact that the electron mass is much smaller than that of any other constituent of the gas. A systematic study is presented of the tensor coefficients for the electron electrical conductivity, thermal conductivity, and thermal diffusion. The interplay between the degrees of ionization and magnetic field in determining the sign of the transverse electron thermal diffusion coefficient has been examined. Simple formulas for the thermal diffusion coefficients in the presence of magnetic field have been obtained. The unified theory of Kihara and Aono for charged particle interactions was applied to obtain improved values of the transport coefficients when the number of particles in a Debye sphere is not large. These have been compared with theories based on a cut-off Coulomb potential, and on a shielded-Coulomb potential. It was found that the unified theory and the shielded-Coulomb theory are in close agreement. Mixture rules were given for all three transport coefficients, including the case when there is a magnetic field present. Simplifications introduced into the Chapman-Enskog method were also demonstrated in obtaining the transport coefficients of the heavy particles of a three component, two temperature plasma. Author (TAB)

N69-27337# Bangalore Univ. (India). Univ. Coll.

THE TRANSIENT SOLUTION FOR STOKES SECOND PROBLEM IN MAGNETOHYDRODYNAMICS

N. Rudraiah 8 Oct. 1968 18 p refs

(PGSAM-1) Avail: CFSTI

The motion of a semi-infinite incompressible conducting fluid caused by the sinusoidal oscillations of a plane insulated flat plate in the presence of a transverse uniform magnetic field is investigated. When the plate starts from rest in a still conducting fluid a transient solution must be added to Stokes form of magnetohydrodynamic steady state solution. The transient solution is first obtained using the Fourier Transform. A closed form solution for this transient solution is then given in terms of exponential and error functions of a complex argument. The final solution we obtained contains the answer for both sin and - cos T boundary conditions. The velocity profile above an oscillating plate is illustrated in figure 1 and the results are compared with the hydrodynamic results. It is found that the transient dies out rapidly with increasing Hartmann type number m as we move away from the plate. Author

N69-27373# Commissariat a l'Energie Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

STUDY OF MICROINSTABILITIES IN A PLASMA OF CONFINED HOT ELECTRONS [ETUDE DE MICROINSTABILITIES DANS UN PLASMA D'ELECTRONS CHAUDS CONFINE]

J. Jacquinot, C. Leloup, J. P. Poffe, M. de Pretis, F. Waelbroeck et al [1968] 14 p refs In FRENCH; ENGLISH summary Presented at 3d Intern. Conf. on Controlled Plasma Phys., Novosibirsk, USSR, 1 Aug. 1968

(CEA-CONF-1006; CN-24/H-11; CONF-680805-28) Avail: AEC Depository Libraries

Several types of microinstabilities appear in plasmas composed principally of hot electrons heated by pulse heating. One of these instabilities modifies the distribution function of the velocities in the confined space. The observations obtained to the present on this instability is compatible with the predictions of a linear theory of the amplification of the electromagnetic waves in a plasma with anisotropic pressure. This theory was generalized to take account of the presence of a significant density of cold plasma. The experimental device is described and the characteristics of the plasma after heating are given. NSA

N69-27375# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDIES OF NONLINEAR PROCESSES [ETUDES DE PROCESSUS NON LINEAIRES]
R. Cano, I. Fidone, C. Etievant, G. Laval, J. Olivain et al [1968] 25 p refs In FRENCH; ENGLISH summary Presented at 3d Intern. Conf. on Controlled Plasma Phys., Novosibirsk, USSR, 1 Aug. 1968 (CEA-CONF-1007; CN-24/E-9; CONF-680805-26) Avail: AEC Depository Libraries

The theory of the nonlinear interaction of three-electron plasma waves received satisfactory experimental confirmation. The parametric amplification permitted the excitation of modes having a high-order spatial structure. It was established that an electron plasma wave can be nonlinearly unstable even for very low oscillation amplitudes. In spite of its length, the decay spectrum in its initial growth phase can be interpreted without recourse to the hypothesis of random phases. The nonlinear interaction produced in the plasma volume common with two beams of electromagnetic waves introduced perpendicular to the magnetic confinement field was studied for the nonlinear interaction of an ordinary wave and an extraordinary wave and for the nonlinear interaction of two ordinary waves. In the experimental study, two emission peaks were observed. The results showed the creation of an electromagnetic wave by resonating nonlinear interaction of two electromagnetic waves. NSA

N69-27380# Los Alamos Scientific Lab., N. Mex.
PLASMA STREAM INTERATIONS THROUGH POLARIZATION ELECTRIC FIELDS
Jay E. Hammel and Ralph W. Kewish, Jr. 27 Jan. 1969 6 p refs
(Contract W-7405-ENG-36)
(LA-3994) Avail: CFSTI

An experiment using two plasma streams with opposing velocities in a transverse magnetic field to observe the interaction of the two opposing polarization electron fields is briefly described. The technique is a possible means of loading a closed-field geometry. The two similar streams are not directly opposed but are displayed from one another along the magnetic field to increase the possibility of a significant interaction. The fast plasma produced by coaxial guns has a density up to 5×10^{14} cm^{-3} and a directed velocity of 60 to 70 cm/μsec. The resultant polarization field in kilogauss magnetic fields is of the order of kV/cm. The lateral stream separation is 54 cm, and at magnetic fields below 3.0 kG the streams have a negligible effect on each other. At high fields (7.0 kG), the streams have a larger interaction under certain conditions, and an increase in desnity is observed. The effects when the two streams differ widely in density and arrival time are discussed. Author (NSA)

N69-27390# Uppsala Univ. (Sweden). Inst. of Physics.
INVARIANCE PROPERTIES OF WAVES IN A STREAMING MAGNETIZED PLASMA
A. Jarmen and H. Wilhelmsson Nov. 1968 4 p refs
(UUIP-615) Avail: AEC Depository Libraries

An electron stream which had a velocity v with respect to the laboratory frame is studied. Two coordinate systems are introduced. In one of them the static current density is zero, i.e., the system is at rest in the frame of the electron gas. The other system, which corresponds to the laboratory frame, then moves with a velocity v. Dispersion relations are given for wave propagation along a static magnetic field in the two systems. It is shown that the dispersion relations can be converted into each other by a transformation. This is in accordance also with a charge density transformation between the two systems. NSA

N69-27426# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF VARIOUS METHODS OF DETERMINING THE TEMPERATURE OF A PLASMA IN A MHD DUCT
S. Suckewer et al 13 Aug. 1968 22 p refs Transl. into ENGLISH of the publ. "Issledovaniya Razlichenykh Metodov Opredeleniya Temperatury Plazmy v Kanale MGD-Generatora SM-197/96" USSR p 1–18 Sponsored jointly by Inst. of Nucl. Res., Swierk, Poland and CEN de Saclay, France
(AD-683133; FTD-MT-24-178-68) Avail: CFSTI CSCL 10/2

The authors report on experimental measurements of the temperature of a plasma consisting of combustion products in an MHD duct. The measurements were made by a number of different methods: absolute spectral line intensity recording; sodium line reversal; a generalized method of spectral line inversion; and dynamic thermocouple. The experimental set-up consisted of an oxy-acetylene combustion chamber and a small MHD duct. The conditions under which the measurements were made were similar to those in large experimental facilities. Using the above methods, the authors compared the results of simultaneous temperature measurements for different combustion chamber operating conditions depending on the amount of line indicator and the quantity of seed. By measuring the temperature in a given region of the plasma by the generalized method of the sodium line reversal and by means of a dynamic thermocouple it was possible to estimate the accuracy of the thermocouple. With the help of the dynamic thermocouple the temperature was also determined as a function of distance from the duct axis. In order to compare the accuracy of the spectral methods of temperature measurement, the authors examined spectrograms obtained in the 4000-7000A region and measured the spectral line contours by means of a Fabry-Perot interferometer. TAB

N69-27434# Commissariat d l'Energie Atomique, Paris (France).
NANOSECOND AXIAL SCHLIEREN PHOTOGRAPHY OF A PLASMA FOCUS
Jean-Pierre Baconnet, Georges Cesari, Alain Coudeville, and Jean-Paul Watteau [1968] 7 p refs In in FRENCH; ENGLISH summary Presented at the Ann. Meeting of the Div. of Plasma Phys., Miami Beach, Fla., 13 Nov. 1968
(CEA-CONF-1204; CONF-681112-4) Avail: AEC Depository Libraries

A coaxial ϕ = 15-mm hole is drilled into the inner ϕ = 50-mm electrode and does not affect the plasma behavior and the neutron yield. Through this hole the beam of a 1-J, 15-ns ruby laser illuminates the plasma and is stopped by a metal disk of diameter ϕ_d in the focal plane of a 750-mm focal length lens. The plasma density gradients larger than a minimum value ranging from 5×10^{18}cm^{-4} (ϕ_d = 1.5 mm) to 2.5×10^{19}cm^{-4} (ϕ_d = 8 mm) are imaged on a 1-ns exposure-time framing camera. Schlieren photographs taken at different times are shown and compared with the luminous front. Before this front penetrates in the hole area, a heterogeneous transient plasma is detected. The plasma sheet is often asymmetric and shows quasi-circular stratifications. When the neutron emission starts (the detection threshold is 100 neutrons ns^{-1} in 4π steradians) a density gradient larger than 8×10^{18}cm^{-4} is observed on an 8-mm-diameter

annulus. The luminous front reaches the axis 100 ns later. During collapse complex structures such as vortices are observed. Author (NSA)

N69-27473# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
NONLINEAR INSTABILITIES IN INHOMOGENEOUS PLASMA
B. Coppi (Inst. for Advanced Study), G. Laval, R. Pellat, and Tu Khiet (Paris Univ., Orsay, France. Lab. Phys. des Plasmas)
[1968] 17 p. refs In FRENCH Presented at 3d Intern. Conf. on Controlled and Plasma Phys., Novosibirsk, USSR, 1 Aug. 1968
(CEA-CONF-1008; CN-24/E-14; CONF-680805-27) Avail: AEC Depository Libraries

When the shearing of the lines of force of a plasma is sufficient to suppress the unstable modes, the plasma can remain locally unstable and can amplify the wave bundles: other stability criteria are then obtained by imposing the restriction that this amplification does not exceed a certain number n_0 of exponentiations. The determination of n_0 is the object of the present study. The stabilizing role of shearing on the localized modes is made precise by calculating explicitly the growth rate of the modes. In the case where the stabilization criteria of the modes is satisfied, the propagation and amplification of the convective modes excited by the thermal fluctuation of the plasma are analyzed. It is shown that a nonlinear reflection mechanism of wave bundles permits a nonlinear instability to be triggered. The same conclusion is obtained by the analysis of a nonlinear instability due to resonating coupling of derivative waves having energy of different signs. Author (NSA)

N69-27476# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
PRODUCTION OF MULTIPLE CHARGED XE IONS
A. S. Pasyuk and V. B. Kutner 1969 5 p refs In RUSSIAN
(JINR-P7-4289) Avail: AEC Depository Libraries

Some characteristics of the multiple charged Xe ion source are given. The intensity of dodecacharged Xe ions is 120μA per pulse. Author (NSA)

N69-27513# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
DRIFT WAVE INSTABILITY ON THE PLASMAPAUSE WITH A SLIGHT MODIFICATION DUE TO THE VELOCITY SHEAR
Takashi Okuzawa Feb. 1969 23 p refs *Its* Vol. 34, No. 2
(ISAS-435-Vol-34-No-2) Avail: CFSTI

A simple model in configuration space being employed, the growth rate of the low frequency universal drift mode and of the drift cyclotron resonance mode are calculated in modified forms through the Vlasov equation. An argument is made not only to interpret the results obtained but also to examine the applicability of the results to the actual plasmapause, in particular, around dusk meridian region, and the possibility is indicated that these instabilities are slightly enhanced in that region. Author

N69-27516# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Gas Ionizzati.
ON THE INFLUENCE OF A RADIAL ELECTRIC FIELD ON THE STABILITY OF A MAGNETICALLY CONFINED PLASMA
A. Nocentini Dec. 1968 14 p refs Prepared jointly with EURATOM
(LGI-68/30) Avail: CFSTI

A magnetically confined, slightly non-uniform and non-neutral plasma column is considered. The existence is shown in plane, infinite geometry, of a mode whose characteristic properties agree with those of an unstable wave detected in a recent experiment. Author (ESRO)

N69-27517# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Gas Ionizzati.
EFFECT OF AN ELECTRON TEMPERATURE MODULATION ON DRIFT WAVES
M. Dobrowolny, F. Engelmann, and A. M. Levine Nov. 1968 27 p refs Prepared jointly with EURATOM
(LGI-68/28) Avail: CFSTI

The possibility of stabilizing dynamically drift waves by modulating the electron temperature is investigated. It is shown that such an effect can occur only in the collisionless regime. It requires that one of the beat modes between drift waves and temperature modulation be resonant with typical ion velocities so that a new dissipative mechanism comes into play. The corresponding stability criteria are derived. Author (ESRO)

N69-27518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICAL BASES OF THE USE OF PLASMA FOR THE GENERATION AND AMPLIFICATION OF SHF OSCILLATIONS
G. A. Bernashevskii et al 17 May 1968 103 p refs Transl. into ENGLISH from Plazmennye i Elektronnye Usiliteli i Generatory SUch (Moscow), 1965 p 1–96
(AD-683275; FTD-MT-24-30-68) Avail: CFSTI CSCL 9/1

Some new methods for amplification and generation of superhigh frequency (SHF) oscillations using electron-ion plasma penetrated by an electron beam and also using a rotating electron beam are considered. In contrast to the usual SHF devices, where the electron beam interacts with electromagnetic fields which are channeled by metallic structures, in plasma SHF devices plasma having a number of new properties is used as the medium channeling the electromagnetic oscillations. The physical principles in utilizing plasma for the generation and amplification of SHF oscillations and the interactions of plasma oscillations with an electron beam are considered in the first part of the book. The basic properties of the interaction which can be used for constructing plasma amplifiers and oscillators are developed. The results of theoretical and experimental studies of plasma amplifiers and oscillators are presented. In the second part centrifugal-electrostatic focusing (CEF) of rotating electron beams is considered. New SHF amplifiers and oscillators, constructed on the basis of this focusing and having a number of advantages over other electron SHF devices, are also discussed. The stability of an electron beam when utilizing CEF is analyzed and the current limit is determined. Experimental studies of traveling wave tubes (TWT) and backward wave tubes (BWT) with central electrostatic focusing are described. The processes of high frequency bunching in a rotating electron beam are considered in linear and nonlinear approximations and it is shown that space-charge self-bunching of the electrons is possible. TAB

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-28173 Columbia Univ., New York.
THE STABILITY OF FERROMAGNETIC DOMAIN STRUCTURES AT GRAIN BOUNDARIES IN SOFT IRON FOILS

Albert George Tobin (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-16938

The magnetic domain structures formed at grain boundaries in recrystallized iron foils were analyzed by Lorenz electron microscopy and by computing the various magnetic energies associated with each domain structure observed. Five basic types of domain structures were observed at grain boundaries in iron: (1) domain walls which penetrate through the boundary indicating no interaction; (2) double spike reverse domains; (3) single spike reverse domains; (4) echelon domains; and (5) domains of closure. The experimental results indicate that the ranges of magnetic pole density over which the above domain structures will form are (1) $0.001\ I_s \leq w \leq 0.07\ I_s$ for the no interaction; (2) $0.01\ I_s \leq w \leq 0.12\ I_s$ for the double spike reverse domain; (3) $0.10\ I_s \leq w \leq 0.28\ I_s$ for the single spike reverse domain; (4) $0.20\ I_s \leq w \leq 0.70\ I_s$ for the echelon domain; and (5) $0.30\ I_s \leq w \leq 1.0\ I_s$ for the domain of closure. (I_s = saturation induction of iron and w = magnetic pole density at the grain boundary). Dissert. Abstr.

N69-26174 Carnegie-Mellon Univ., Pittsburgh, Pa.
EFFECT OF WATER ON CRACK PROPAGATION IN MgO CRYSTALS
Donald Albert Shockey, Jr. (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-17644

A double cantilever beam technique in which cracks were extended intermittently was used to study the effect of water on crack propagation in MgO crystals. It was often possible to define a constant apparent surface energy for a specimen in a given environment, although values varied widely from specimen to specimen in the range 1200 to 2800 ergs/cm^2 in air. Tests on many specimens in which the environment was changed from air to water producted two significant results. The first was a toughening of MgO crystals by the water of from 25% to 150%. Increases in apparent surface energy of from 25% to 40% were measured when propagation occurred by sharp, high-velocity jumps. When the crack advanced slowly, increases in apparent surface energy in the range from 125% to 150% were obtained. The second result was a change in the fracture plane from the usual (100) cleavage plane in air, to a saw-tooth-like fracture surface in water. Dissert. Abstr.

N69-26178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF INTERCRYSTALLINE BARRIERS ON THE KINETICS OF PHOTOCONDUCTIVITY
Yu. K. Vishchakas et al 14 Nov. 1968 12 p refs Transl. into ENGLISH from Lietuvos Fiz. Rinkinys, Lietuvos TSR Moksalu Akad., Lietuvos TSR Aukstosios Mokyklos (Vilna), v. 8, no. 4 1968 p 561–568
(AD-683952; FTD-HT-23-652-68) Avail: CFSTI CSCL 20/12

The kinetics of the electronic processes at a contact of 2 pieces of a semiconductor separated by a potential barrier, are investigated. The barrier is assumed to be created by captured carriers in surface states. The kinetics of the increase and decrease in the photocurrent is asymmetric, and at large intensities it has a characteristic S-shape. Calculated results are in reasonable agreement with results obtained experimentally on powdered ZnO. TAB

N69-26204# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTENSITY IN THE CASE OF NONLOCAL VIBRATIONS
R. M. Sabirov 8 Aug. 1968 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 6, 1967 p 81–86
(AD-683141; FTD-HT-23-481-68) Avail: CFSTI CSCL 20/2

The phonon spectra obtained by S. I. Mesharov are used to calculate the intensity of the Mossbauer line for crystals with vacancies and for solid solutions with one atom per unit cell, assuming that there are now local vibrations. The vibrations are considered in the harmonic approximation. The vacancy and impurity-atom concentrations are assumed to be small. It is shown that vacancies always decrease the absorption cross section and the Mossbauer-line intensity, and have a stronger influence on the intensity at high temperatures. In the case of solid solutions, the intensity of the Mossbauer linn can increase or decrease, depending on the ratio of the masses of the component atoms and on their coupling parameters. The results can be used to determine the vacancy concentration. TAB

N69-26216# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHIFT OF THE EDGE OF SELF-ABSORPTION IN AN ELECTRIC FIELD OF CdTe SINGLE CRYSTALS AND FILMS
L. N. Strel'tsov et al 22 Nov. 1968 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (Moscow), v. 4, no. 4, 1968 p 618–620
(AD-683967; FTD-HT-23-1003-68) Avail: CFSTI CSCL 20/12

To clarify certain discrepancies between the results of measuring the edge shift in the CdTe thin film absorption at room temperature in a constant electric field and those obtained theoretically, the edge shift in the CdTe thin film and single crystal absorption was studied in a variable electric field at the temperature of liquid nitrogen. Measurements were made on single crystals obtained from a gaseous phase and by the method of horizontal zonal fusion, and on thin films obtained by thermal deposition in vacuum on a glass substrate. The single crystals ranged in thickness from 2350 to 300 micrometers which made it possible to obtain different fields. The nature of the edge shift was found to be identical for all single crystals. The shift was determined at the maximum of spectral dependence of density variation on the applied field. In the case of thin films the earlier deviations from the theory are explained by the effect of intercrystalline fields. TAB

N69-26251# Research Triangle Inst., Durham, N.C.
INFLUENCE OF DYNAMIC STRAIN ON SILICON JUNCTIONS Interim Report, 1 Jan. 1967–1 Jan. 1969
J. J. Wortman, L. K. Monteith, and A. D. Brooks Jan. 1969 88 p refs
(Contract F44620-67-C-0048)
(AD-683700; AFOSR-69-0182TR; IR-1) Avail: CFSTI CSCL 20/12

The effect of large strains on the electrical properties of p-n junctions was studied by electromagnetically driving with a sinusoidal force a cantilevered silicon beam into which the junctions are diffused. Stress levels greater than 10 to the 9th power dynes/sq cm was obtained at the natural resonant frequency of the beam (typically 200 Hz). An asymmetry was observed in the junction current which shows clearly a difference in response to compressive and tensile forces. With increasing compressive forces the usual increase in junction current was observed. In tension, however, an increasing force first resulted in a decreasing current then an increasing current. No first order influences of time dependent lifetime effects or reversible defect creation in the junctions were observable. These observations are correlated with a theoretical model for the piezojunction effect based on stress induced changes in the energy band structure of the material. Author (TAB)

N69-26281*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
STUDY OF SEMICONDUCTOR HETEROJUNCTIONS OF ZINC SELENIDE, GALLIUM ARSENIDE, AND GERMANIUM

D. L. Feucht and A. G. Milnes Apr. 1969 36 p refs
(Grant NGR-39-087-002)
(NASA-CR-101139) Avail: CFSTI CSCL 20L

The fabrication and properties of GaAs-Ge, ZnSe-Ge and GaAs-ZnSe heterojunctions are being studied. The problems associated with autodoping in the growth of GaAs on Ge encountered with a closed-spaced HCl process are discussed. The doping and contacting of ZnSe layers grown by this process are also considered in depth. A high-frequency transistor measuring system was completed and checked on commercial homojunction transistors. Three methods of growing Ge epitaxially on ZnSe or GaAs at low temperatures are presently being investigated and are considered in this report. Author

N69-26289 Alabama Univ., University.
A THEORETICAL STUDY OF THE EFFECTS OF SURFACE IMPURITIES ON LATTICE RESPONSE AND TRAPPING
Arthur Ross Du Charme, Jr. (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-15485

The trapping of incident particles on a semi-infinite, multi-dimensional lattice with an impurity surface was studied. The trapping process occurs when an incident particle suffers an inelastic collision with the lattice, loses a critical amount of its initial kinetic energy, and remains on the surface as an increment in the crystal growth. The model used has basic cubic symmetry, where similar interior particles interact harmonically with their six nearest neighbors. A one-particle thick surface impurity is allowed. Multiple transform techniques were used to derive the initial value response of the lattice in terms of Lommel functions. Interaction of the lattice with an incident particle through a truncated harmonic potential led to a prediction of energy dependent adhesion. The masses of the incident, surface, and interior particles, as well as the strengths of their mutual harmonic interactions, exist as parameters in the solution. Numerical evaluation of the initial value solution was made and parametric dependence thereby obtained. Results indicate that the multi-dimensional impurity model traps more efficiently than previous one-dimensional impurity models. Significant deviations in trapping efficiency from clean surface model solutions were also found. Dissert. Abstr.

N69-26303# Stanford Univ., Calif. High Energy Physics Lab.
ELECTRIC FIELD PROFILE AND ELECTRON DRIFT VELOCITIES IN LITHIUM DRIFTED SILICON
H. R. Zulliger, C. B. Norris, T. W. Sigmon, and R. H. Pehl Dec. 1968 32 p refs Prepared in cooperation with Calif. Univ., Berkeley
(Contracts AF 49(638)-1499; Nonr-225(67))
(AD-683711; HEPL-591) Avail: CFSTI CSCL 20/12

The electric field profile and the drift velocity of electrons in lithium drifted silicon in the direction at room temperature have been measured. By injecting short bursts of 10 keV electrons into reverse biased diodes, current pulses were produced and viewed on a sampling oscilloscope. To improve the accuracy of the measurement, a picosecond signal averaging system was employed. Electric field profiles in thin Si(Li) showed an overcompensation of the p material near the n+ contact due to the lithium diffusion process. Drift velocity measurements as a function of electric field over the range from 2.0 to 48 kV/cm were obtained. At 48 kV/cm, the drift velocity of 8.6 x 10 to the 6th power cm/sec is not yet a saturation value. Author (TAB)

N69-26439*# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
MICROWAVE DEVICE INVESTIGATIONS Semiannual Progress Report, 1 Oct. 1968–1 Apr. 1969
W. R. Curtice, W. D. Getty, G. I. Haddad, and R. J. Lomax 1 Apr. 1969 43 p refs
(Grant NGL-23-005-183)
(NASA-CR-101115; SAPR-5) Avail: CFSTI CSCL 20L

Theoretical and experimental investigations of the saturation characteristics of beam-plasma devices are discussed. The gain, power output, efficiency, and the magnitude of the higher harmonic components that pertain to such devices are of particular interest. The geometry consists of a cylindrical plasma column which serves as a slow-wave circuit along which electromagnetic energy can propagate. A cylindrical electron stream is assumed to be concentric with the plasma column. Amplification of an RF signal takes place when a fraction of the kinetic energy of the stream electrons is converted into RF wave energy. Author

N69-26473# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
ESR OF Mn^{2+} IN FERROELECTRIC $LiTaO_3$ OF $LiNbO_3$ SINGLE CRYSTALS
J. C. Danner, D. N. Stamires, and U. Ranon Dec. 1968 12 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co. *Its* Res. Commun. No. 86
(AD-683564) Avail: Issuing Activity CSCL 20/2

Measurement of the ESR spectrum of Mn2+ in single crystals of LiTaO3 and LiNbO3 at 300, 4.2, and 1.8 degrees K, discloses relatively large axial crystal-field splittings. A possible correlation between these splittings and the Li 1+ site geometry in both hosts is discussed. Author (TAB)

N69-26568 Clark Univ., Worcester, Mass.
EFFECTS OF LONG RANGE FORCES ON THE FREQUENCY SPECTRUM OF A THREE-DIMENSIONAL CRYSTAL
Peter Demerton Yedinak (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-17242

A study is presented of a monatomic orthrhombic N-dimensional lattice in which the particles vibrate in N dimensions. We assume that the particles interact with both a long range pair potential of the form $1/r^L$ and a short range pair potential of the form $1/r^s$. Working in the harmonic approximation, we determine the long range contribution to the coefficients in the secular equation and find a critical point P in phase space where the coefficients are nonanalytic. This nonanalytic behavior results solely from the long range nature of the potential. The nonanalytic terms dominate the other terms in the coefficients for all $L \leq N$. We next restrict our study to a simple cubic crystal. For this three dimensional model, we determine the behavior of the dispersion relations in the neighborhood of P for all L in the range $1 \leq L \leq 3$. Dissert. Abstr.

N69-26592# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.
SIZE EFFECTS ON THE DIAMAGNETIC SUSCEPTIBILITY OF A FREE ELECTRON GAS
D. Childers and P. Pincus Nov. 1968 27 p refs Prepared in cooperation with Calif. Univ.
(AD-683559; Douglas Paper-5290) Avail: Issuing Activity CSCL 20/12

A noninteracting electron gas constrained in one dimension by an harmonic oscillator potential is used as a model of a metallic film with specular surfaces. The diamagnetic response of this system to an applied field is investigated to study the effect of sample size on both the de Haas-van Alphen oscillations and the steady susceptibility. When the diameters of the dominant cyclotron orbits become comparable to the effective sample thickness, we

and large departures from the familiar 1/H law for the dH-vA oscillations. However, the steady part of the susceptibility appears to remain independent of size. Author (TAB)

N69-26618# Southern Illinois Univ., Carbondale. Materials Science Lab.

STLPLT: CALCOMP PLOT OF CRYSTALLOGRAPHIC PROJECTIONS OF LAUE PHOTOGRAPHS

Marisa Canut-Amoros and Craig Walters Dec. 1968 43 p refs

(Grant AF-AFOSR-832-67)

(AD-683740; Rept-3; AFOSR-69-0456-TR) Avail: CFSTI CSCL 20/2

A computing program STLPLT is described which allows the plot of stereographic, stereognomonic or gnomonic projection from the x, y coordinates of the Laue spots measured in millimeters in the film. The cylindrical, flat transmission and flat back-reflection Laue techniques can be used. The selected projection is plotted in a circle of 100 mm. radius for any desired radius of the reference sphere. The blind zones of the experimental record are also plotted in the projection. The program is written in FORTRAN-IV for IBM 7074 and generates a tape to be used in a CalComp plotter. Author (TAB)

N69-26621# Southern Illinois Univ., Carbondale. Materials Science Lab.

A SET OF COMPUTING PROGRAMS SUPPORTING THE SELECTED ELECTRON SHELL METHOD

Marisa Canut-Amoros, Thomas Q. Casper, and Craig Walters Nov. 1968 137 p refs

(Grant AF-AFOSR-832-67)

(AD-683739; AFOSR-69-0444TR; REPT-1) Avail: CFSTI CSCL 20/2

The SES (Selected Electron Shell) method could not be used as a practical method without proper implementation by computing programs. A considerable effort was devoted, therefore, to this end. The special report was produced that describes in detail the following programs and their results: LNPLT - Semilogarithmic plot of x-ray scattering or structure factors; RVPUN - HKL structure factor data cards with reciprocal vector; GSFPLT - Gaussian scattering factor plot; TFCNV - Temperature factor and Gaussian conversion; CONVU - Electron density functions by convolution; DIFTAP - Difference tape; PFPLT - Peak function plot; and ADDATA - Structure factor data tape; that are used in the elaborate sequence of operations needed for the SES method. Author (TAB)

N69-26643# Douglas Aircraft Co., Inc., Huntington Beach, Calif. Advanced Research Labs.

ELECTRON SPIN RESONANCE OF Mn^{2+} IN CdF_2

D. N. Stamires and U. Ranon Jul. 1968 16 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co. *Its* Res. Commun. No. 67

(AD-683552) Avail: Issuing Activity CSCL 20/12

The electron spin resonance of Mn(2+) in CdF2 is measured, and the Mn(2+) - F(-) interaction parameters are determined. Results are compared with those for other fluorides, and discussed in the light of the interplay of the fine, hyperfine, and superhyperfine interactions. Author (TAB)

N69-26728 Pittsburgh Univ., Pa.

THE CRYSTAL STRUCTURES OF THE TETRAHYDRATES OF TETRAMETHYLAMMONIUM FLUORIDE AND TETRAMETHYLAMMONIUM SULFATE, A REFINEMENT OF THE CRYSTAL STRUCTURE OF ENARGITE AND THE CRYSTAL STRUCTURE OF HEMIHEDRITE

Willis John McLean (Ph. D. Thesis) 1968 88 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-18630

This dissertation describes the X-ray diffraction determination of three formerly unknown crystal structures and the refinement of one previously reported structure. Tetramethylammonium fluoride tetrahydrate is tetragonal, space group $I4_1/a$ with a = 10.853 and c = 8.065 Å at −26°C. Three-dimensional film data were collected at −25° to −30°C, and the structure was determined from the crystal data and the Patterson synthesis and refined by least squares to an R factor of 0.06. Tetramethylammonium sulfate tetrahydrate is orthorhombic, space group $Pna2_1$ or Pnam with cell dimensions a = 15.438, b = 13.832 and c = 7.923 Å at −26°C. Three-dimensional film data were collected at −20° to −30°C, and the structure was determined by the use of the heavy atom and minimum functions and refined by least squares to an R factor of 0.12. Three-dimensional counter data was used to refine the crystal structure of enargite. The final R factor was 0.05. No definite evidence of disorder was found. Hemihedrite is a triclinic lead zinc chromate mineral with cell dimensions a = 9.497, b = 11.443, c = 10.841 Å, α = 120.50°, β = 92.10° and γ = 55.84°. Three-dimensional counter data were collected, and the structure was solved from the Patterson function and refined to an R factor of 0.04. Dissert. Abstr.

N69-26744 California Univ., San Diego.

CRYSTAL STRUCTURE OF CYTOCHROME c_2 AT LOW RESOLUTION (5Å)

Sarjant Singh (Ph.D. Thesis) 1968 163 p

Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-17468

The crystals for X-ray structure analysis were grown in 40-50% ammonium sulfate solution at pH 6 and 1-3% protein concentration. The maximum size of the crystals was 0.8 mm × 0.6 mm × 0.3 mm. Intensities were measured on a manual diffractometer to 5 Å resolution on crystals which were 90% oxidized, using nickel-filtered copper K_α radiation. From the electron density map the molecule of cytochrome c_2 was identified. The heme group, a flattened oval ball of 8-10 Å in cross-section, is well embedded on one side of the central core of hydrophobic side chains. High redox potential is accounted for by the deep embedment of the heme. Its inactivity towards mammalian cytochrome c oxidase compared to the activity of horse heart cytochrome c can be explained on the basis of deep embedment of the heme, few positive charges on active surface, and presence of an extra segment of residues 81-88 blocking the attachment site for the enzyme. The solubility of the protein was explained on the basis of close contact of outside surface with salt solution. Dissert. Abstr.

N69-26765# Israel Program for Scientific Translations, Ltd., Jerusalem.

SLOW-RATE WORK-HARDENING OF PURE ALUMINUM SINGLE CRYSTALS

I. A. Gindin et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 438-440 refs (See N69-26751 14-23)

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The physical mechanism of work hardening and the optimum loading schedule was established by investigating the rate of hardening under slow loading. Soft compressive loading was applied to crystal rods of aluminum at room temperature. The deformation was measured with a high precision inductive strain gage. The yield strength was determined by rapidly loading the specimen to less than 0.001% permanent set and then rapidly unloading. Work hardening was then determined by repeating the yield strength measurement after an interval greater than the after-effect time. B.P.

N69-26767# Israel Program For Scientific Translations, Ltd., Jerusalem.
CRYSTAL STRUCTURE OF $CaAl_2Si_2$ AND ITS ANALOGS
E. I. Gladyshevskii et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 447–452 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

Alloys were prepared from Ca, Al, and Si single crystals in an electric arc furnace in an argon atmosphere. X-ray analysis revealed the existence of $Ca(Al,Si)_2$ and another ternary compound with a narrow homogeneity region. The structure of the $CaAl_2Si_2$ compound was determined from X-ray diffraction patterns of its single crystal. Other alloys were prepared, substituting strontium or barium for calcium, and germanium for silicon, to find similar isostructural compounds. Powder diagrams and lattice constants are tabulated for all the alloys. The compounds $CaAl_2Si_2$, $SrAl_2Si_2$, $SrAl_2Ge_2$, and $CaAl_2Ge_2$ constitute a new group of normal valency ternary intermetallic compounds of the composition A_3B_2 with an anionogenic element of subgroup 4B. B.P.

N69-26769# Israel Program For Scientific Translations, Ltd., Jerusalem.
CONDUCTIVITY OF A Hg-GaAs RECTIFYING CONTRACT
A. K. Tereshchenko *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 456–459 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The forward current-voltage characteristics of the Hg–GaAs rectifying contact were experimentally studied using both freshly cleaved and oxidized GaAs surfaces to determine the dependence of the coefficient β on the semiconductor surface condition. Some peculiar features in the variation of β were discovered (anomalously high β values for freshly cleaved surfaces, β decreasing as the GaAs surface was oxidized) and the results were interpreted with the aid of the theory of metal-semiconductor contact rectification. B.P.

N69-26770# Israel Program For Scientific Translations, Ltd., Jerusalem.
THE EFFECT OF COPPER IMPURITY ON THE FORMATION OF TRAPPING CENTERS AND X-RAY LUMINESCENCE OF NaI CRYSTALS
Z. B. Baturicheva et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 474–476 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The trapping centers formed by copper in NaI and NaI(Tl) crystals were studied in order to assess the effect of these centers on X-ray luminescence intensity. X-ray luminescence and thermoluminescence were measured for NaI(Cu) and NaI(Tl, Cu) crystals X-rayed at room temperature. Thermoluminescence curves are discussed with regard to peaks formed with an increasing copper concentration, with plastic deformation before X-raying, at higher temperatures, with standard concentration of thallium, and with UV light irradiation of 3130 or 3650 Å. It was experimentally shown that copper peaks appear on the thermoluminescence curves of some NaI(Tl) crystals without any intentionally introduced copper. The thermoluminescence peaks at 85 to 100° C, which are the main maxima for NaI(Cu) crystals X-rayed at room temperature, are small in the spectra of crystals with a different activator. The copper impurity increases the luminescence buildup time and the intensity increment of X-ray luminescence and affects the curves of luminous efficiency of NaI(Tl) crystals vs. temperature. The experiments suggest that copper impurity is a poison for NaI(Tl) scintillators. P.A.B.

N69-26782# Israel Program For Scientific Translations, Ltd., Jerusalem.
THE EFFECT OF SOME IMPURITIES AND THERMOMECHANICAL TREATMENT ON PHOTOMECHANICAL EFFECT IN GERMANIUM
N. Ya. Goridko et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 485–488 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The photomechanical effect is defined as a reduction in hardness after irradiation with light of certain wavelengths; its dependence on the concentration of various impurities in samples and on their thermomechanical treatment is studied. Electrically inactive impurities (hydrogen, helium, nitrogen, and oxygen) were used. The germanium samples were subjected to several kinds of thermomechanical treatments, including grinding, polishing, and annealing. Vacuum annealing of germanium cancels the photomechanical effect, but it reappears once the specimen is ground, polished, and annealed in a hydrogen atmosphere. The reasons for this reappearance are discussed, and an experiment measuring the photomechanical effect in stressed and unstressed regions of germanium and silicon is summarized. The photomechanical effect was also studied as a function of depth in specimens annealed for two hours at 820° C in an atmosphere of hydrogen, helium, nitrogen, and oxygen. Silicon annealed in a hydrogen atmosphere displays a photomechanical effect, but no effect is seen in specimens annealed in the other gases. P.A.B.

N69-26787# Israel Program For Scientific Translations, Ltd., Jerusalem.
A STUDY OF THE SPECTRAL DISTRIBUTION OF PHOTOELECTRIC RESPONSE OF In_4S_5 SINGLE CRYSTALS
V. A. Lyubchenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 497–500 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

Results are presented on the spectral distribution of the steady state photoelectric response for In_4S_5 crystals. Figures are supplied which plot the spectral photoconductivity response of a typical In_4S_5 crystal, and the spectral variation of the phenomenological relaxation time and phenomenological photocurrent yield for low and high levels of photoexcitation. The experimental trends are explained by the existence of fast trap levels on the crystal surface. P.A.B.

N69-26790# Israel Program For Scientific Translations, Ltd., Jerusalem.
TEMPERATURE DEPENDENCE OF THE FORBIDDEN GAP OF SOME A(V) B_3(VII) CRYSTALS
I. D. Turyanitsa et al *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 504–506 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The forbidden gap AsI_3, SbI_3, and BiI_3 was investigated as a function of temperature via the position of the long wave absorption edge at various temperatures. The tests were carried out on single crystals grown from the gaseous phase in evacuated capsules and polycrystalline films sublimated onto a glass base. The absorption spectra were investigated photographically and photoelectrically in the temperature range of 90 to 420° K. These absorption spectra show that the long wave edge of the absorption band shifts in the short wave direction as the temperature is decreased. The existence of direct allowed transitions is indicated. The forbidden gap at various temperatures is obtained by extrapolation and is shown to be a linear function of temperature. P.A.B.

N69-26791# Israel Program For Scientific Translations, Ltd., Jerusalem.
THE THEORY OF MAGNETORESISTANCE OF POLAR CRYSTALS
I. V. Gvozdovskii *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 506–508 refs (See N69-26751 14-23)
Copyright. Avail: CFSTI

The kinetic equation of the electron gas interacting with optical lattice vibrations in the presence of an external homogeneous magnetic field is written as a second order finite difference equation. The method by which the change in conductivity in a magnetic field and the Hall constant can be found is outlined for the case of high temperatures, for both weak fields and strong fields. It is noted that the existence of relaxation time is confirmed, since at high temperatures the collisions of electrons with optical phonons can be regarded as elastic. A method for the solution of the equation in the low temperature case, where the scattering is essentially inelastic, is then summarized, employing the expansion of the exact solution in powers of a small parameter. P.A.B.

N69-26799# Israel Program for Scientific Translations, Ltd., Jerusalem.

LOW-TEMPERATURE PECULIARITIES IN THE REFLECTION SPECTRA OF ANTHRACENE CRYSTALS IN THE REGION OF EXCITON EXCITATION

S. V. Marisova *In its* Ukrain. Phys. J., Vol. 12, No. 3 1967 p 523–525 refs (See N69-26751 14-23)

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The reflection spectrum observed near the band of the first pure electron transition is considered for anthracene single crystals with specular faces. The spectra of two crystals 13 and 45 μ thick, obtained under identical conditions of illumination and polarization at 4°K, are presented, and the variation of reflectance in the absorption band is plotted. Two distinct dips observed in the spectrograms and curves are discussed, and tentative interpretations are offered concerning the nature of the fine structure of the reflection spectrum. P.A.B.

N69-26804# Picatinny Arsenal, Dover, N.J. Feltman Research Labs.

CONDUCTION AND ELECTRICAL SWITCHING IN AMORPHOUS CHALCOGENIDE SEMICONDUCTOR FILMS

P. J. Walsh, Ruth Vogel, and E. J. Evans Nov. 1968 24 p refs

(AD-683465; PA-TR-3765) Avail: CFSTI CSCL 20/12

Experimental evidence is presented bearing on the low current conduction and on the rapid electrical switching phenomena that have been found in thin films of certain amorphous chalcogenide semiconducting materials. The principal findings are that (1) the low current conduction consists of an ohmic region linear with voltage and an exponentially varying nonlinear region, both of which arise from the same conduction process; (2) at voltages just below switching, the equivalent parallel capacitance of the film becomes negative; and (3) a field-influenced dielectric phase transition is implicated in the switching process. The phase transition temperature appears to be related to the glass transition temperature.
Author (TAB)

N69-26864 Iowa Univ., Iowa City.

CHARACTERIZATION OF POROUS MEDIA BY FREQUENCY RESPONSE ANALYSIS

Kwang-Kuk Koh (Ph.D. Thesis) 1968 86 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16823

A method is introduced to characterize a porous structure by a distributed parameter model, along with Turner's dead-end pore model. The analysis of experimental data is carried out in the frequency domain. A transfer function is obtained from a set of partial differential equations which describe a porous medium system. The experimental data were taken by applying a sinusoidal pressure wave on the other side of a porous medium, and measuring response pressure wave on the other side of a porous solid. Pulse testing method was also employed, and the data were compared with that of the direct sinusoidal forcing method. Although fairly good agreement between experimental and calculated frequency response data were obtained, the frequency range was limited by the sensitivity of the measuring device and mechanical limitation of signal generator. The proportion of dead-end pores were estimated from measured frequency response data for several porous solids. Dissert. Abstr.

N69-26913# Israel Program For Scientific Translations, Ltd., Jerusalem.

KINETICS OF ELECTRON EXCHANGE BETWEEN SURFACE BANDS AND THE BULK IN SEMICONDUCTORS

A. V. Sachenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 577–585 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

The kinetic equations of electron and hole exchange between nondegenerate surface bands and the bulk coincide in our model with the equations for two discrete surface levels, one with a Boltzmann distribution of electrons and the other with a Boltzmann distribution of holes. The parameters of the surface bands can be reduced to the parameters of surface levels in this case. The effective density of states in the surface band being known from experiment, the effective mass of current carriers in the band can be readily found. Kinetic equations of exchange between surface bands and the bulk are substantially different from the equations for surface levels if the bands are degenerate. All the equations were derived with the minimum number of assumptions. They can now be applied to solve various particular problems, e.g., field effect kinetics, photoconductivity kinetics, etc., for clean germanium and silicon surfaces. Author

N69-26914# Israel Program For Scientific Translations, Ltd., Jerusalem.

A STUDY OF ELECTRON STATES ON ATOMICALLY CLEAN SILICON SURFACE

B. A. Westemko et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 586–592 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

We investigated the field effect on an AC surface of n- and p-type silicon. The results enable us to visualize the silicon surface produced by bombardment and annealing as comprising two bands (or two levels) with state concentration $\sim 10^{14} cm^{-2}$ and state density $\sim 10^{15} cm^{-2} eV^{-1}$, each distant ~0.1 eV from the Fermi level. The effective mass of a hole in band II was estimated for the band model from the measured state density. Comparison of experimental findings with theory yielded some parameters of the surface states in the discrete model (capture cross sections, concentration energies). Author

N69-26915# Israel Program For Scientific Translations, Ltd., Jerusalem.

THE EFFECT OF SURFACE RECOMBINATION ON PHOTOCONDUCTIVITY KINETICS IN SEMICONDUCTORS

V. K. Malyutenko et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 593–600 refs (See N69-26905 14-23)

Copyright. Avail: CFSTI

Studied is the photoconductivity time-constant frequency dependence of the recombination mechanisms in germanium and cadmium sulfide semiconductors illuminated by readily absorbed wavelengths. Calculations show that the ambipolar photoconductivity is highly sensitive to surface recombinations but that at low frequency saturation minority carriers generated are trapped by bulk recombination levels and the total number of photocurrent carriers diminishes. Unipolar photoconductive frequency dependency measurements on silicon specimen reveal that surface levels, in addition to fast recombination levels, also include a level which is responsible for the accumulation of minority carriers. The flux of

nonequilibrium holes is redistributed between the surface trap level and the bulk recombination level with electrons remaining relatively long in the conduction band before recombining with the detached holes. G.G.

N69-26916# Israel Program for Scientific Translations, Ltd., Jerusalem.
LOW-TEMPERATURE ELECTRICAL PROPERTIES OF Au-DOPED Cd-Sb
L. I. Zarubin et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 601–606 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

The resistivity and the Hall effect were studied in Au-doped CdSb crystals with carrier concentrations from $1 \cdot 10^{15}$ to $4 \cdot 10^{18}$ cm^{-3} at temperatures from 1.5 to 400°K. Above 77°K, θ(T) and R(T) are represented by typical semiconductor curves. Certain anomalies are observed, however, at low temperatures: the R(T) curve has a maximum and θ is virtually constant at low temperatures. The results point to the existence of an impurity (acceptor) band in this semiconductor. Energy estimates indicate that the impurity band is not wider than $(1.0 - 1.5) \cdot 10^{-3}$eV and that the activation energy of Au acceptor centers is $(3.5 \pm 0.3) \cdot 10^{-3}$eV. Author

N69-26917# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE EFFECT OF THERMAL TREATMENT IN HYDROGEN ON THE SPECTRAL DISTRIBUTION OF PHOTOCONDUCTIVITY OF CADMIUM SULFIDE CRYSTALS
N. F. Malyuk et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 607–611 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

Annealing effects on cadmium sulfide crystals in hydrogen changed the spectral characteristics of photoconductivity markedly. Photoresponse and dark resistance values depended on: (1) the properties of the initial crystal; (2) the annealing temperature; (3) the annealing time; (4) the hydrogen pressure; and (5) the rate of cooling. Heat treatment in hydrogen sensitized low photoresponse insulating CdS crystals and enchanced their ultraviolet photoresponse. G.G.

N69-26918# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE BEHAVIOR OF POLYCRYSTALLINE CdS_xSe_{1-x} FILM PHOTORESISTORS OVER A WIDE RANGE OF LIGHT INTENSITIES
A. G. Rokakh et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 612–614 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

Light and frequency characteristics of polycrystalline CdS_xSe_{1-x} films were studied by measuring their photocurrent response over a wide range of light intensities. Results indicated that trap levels did not have a marked influence on the kinetics of photoconductivity processes as they were completely occupied by electrons even at low intensities. G.G.

N69-26919# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE DEPENDENCE OF THERMOELECTRIC PROPERTIES OF CdSb POLYCRYSTALS ON THEIR STRUCTURAL STATE
N. L. Kostur et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 615–621 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

The temperature dependence of the thermoelectric properties of single-phase polycrystalline CdSb specimens produced by crystallization from a melt superheated by 10–30° or alloys crystallized according to the metastable Cd–Sb phase diagram and subjected to temperature annealing is virtually the same as that for CdSb single crystals. Inhomogeneity of structure and composition and multiphase constitution of the polycrystalline CdSb specimens are the result of crystallization of highly superheated melts followed by decomposition of the metastable Cd_4Sb_3 phase in the solid state. In the impurity conductivity region, the temperature coefficient of resistance is negative, the hole mobility increases with the increase in temperature, the thermal e.m.f. markedly increases and the concentration of current carriers increases. The CdSb hole conductivity is retained in all polycrystalline alloys. The observed variation in properties may be attributed to the lattice defects in CdSb, nonuniform composition, and existence of potential barriers and surface charge in the bulk of the alloy. Author

N69-26924# Israel Program For Scientific Translations, Ltd., Jerusalem.
STRUCTURE OF LITHIUM FILMS ON THE [110] FACE OF TUNGSTEN
D. A. Gorodetskii et al *In its* Ukrain. Phys. J., Vol. 12, No. 4 1967 p 646–651 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

Slow electron diffraction studies were made of lithium films on the [110] face of tungsten. The diffraction pattern was displayed on a luminescent screen. The lithium source did not alter the vacuum after high temperature heating and conditioning, and the system was maintained at $(1–2) \times 10^{-9}$ mm Hg. The quality of the deposited lithium was determined from the current-voltage characteristics of the crystal in a resisting field. Following conclusions as to the relative positions of the lithium atoms drawn from the experimental data, it is posited that to find the exact position of the lithium atoms relative to the tungsten lattice, the diffraction intensities must be measured as a function of the primary electron energy and combined with the atomic functions for law energy electron scattering by lithium and tungsten. K.R.G.

N69-26925# Israel Program For Scientific Translations, Ltd., Jerusalem.
A STUDY OF QUENCHING DEFECTS IN DISLOCATION-FREE GERMANIUM
A. D. Belyaev et al *In its* Ukrain. Phys., J., Vol. 12, No. 4 1967 p 652–657 refs (See N69-26905 14-23)
Copyright. Avail: CFSTI

The effect of quenching defects on single-crystal dislocation-free germanium is studied. The influence of the defects on some electrophysical characteristics (conductivity and carrier lifetime) and on the anomalous transmission of X-rays in germanium is investigated. The latter effect is known to be sensitive to crystal defects, e.g., impurities (Cu and Ni) and dislocations. Special measures were taken to minimize the danger of specimen contamination by rapidly diffusing impurities (Cu and Ni) on the one hand, and by plastic deformation on the other. The results indicate that the thermal centers studied under these conditions are probably associated with vacancies in the crystal lattice. K.R.G.

N69-26948 Alfred Univ., N.Y. Coll. of Ceramics.
CARBON SELF-DIFFUSION IN POLYCRYSTALLINE TUNGSTEN CARBIDE
Charles Paul Buhsmer, Jr. (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-16616

Dense, hot pressed tungsten carbide specimens were used to study the self-diffusion of C^{14} into WC. The C^{14} was applied to the optically flat sample surface by means of a radioactive slurry and diffusion anneals performed on the diffusion couple in purified helium atmosphere at temperatures ranging from 2238°K to 2643°K. The existence of two clearly delineated diffusion mechanisms

was demonstrated. The first obeyed a bulk diffusion law, (linear plots of ln activity versus penetration depth squared) originated at the specimen surface, showed anomalously low diffusion coefficients, ($\approx 10^{-15}$cm^2/sec) dominated to a depth of about one micron, and from an Arrhenius plot showed an apparent activation energy of 88 kcal/mole. Autoradiography demonstrated that the second mechanism was grain-boundary diffusion, and it dominated at depths of greater than one micron. Dissert. Abstr.

N69-26963# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTRONIC SPECTRA OF RARE EARTH METAL FLUORIDES, OXYFLUORIDES AND OXIDES
S. S. Batsanov et al 1969 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 10, no. 2, Feb. 1969, p 332–336
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Electronic spectra for a whole series of rare earth metal compounds are presented and described. A clear band shift towards the long wavelength side is shown in the series $LnF_3 \rightarrow LnOF \rightarrow Ln_2O_3$. Energy levels are tabulated for the Nd^{3+} ion in NdF_3, NdOF, and Nd_2O_3. It is felt that the data show a correlation between the ionic property of the chemical bond and the spectral characteristics of the rare earth metal atoms. N.E.N.

N69-26964# Rutgers Univ., New Brunswick, N.J. Dept. of Physics.
LOW TEMPERATURE THERMAL AND ELECTRIC PROPERTIES OF CRYSTALS Final Report
G. K. Horton Arlington, Va. AFOSR 14 Feb. 1969 6 p refs
(Grant AF-OSR-726-65)
(AD-683343; AFOSR-69-0281-TR) Avail: CFSTI CSCL 20/12

The research described in this report studies the temperature dependence of the change of the local magnetic field near a Xenon atom due to interatomic interactions. Higher order cluster effects, anharmonic contributions in the solid phase and an improved treatment of the exchange interaction are considered. Further studies include the strain dependence of the Helmholtz free energy up to second order as well as first and second order temperature derivatives. We have thus been able to understand the magnitude of the anharmonic contributions, for a simple model potential, to elastic constants, the specific heat, entropy etc. The theory of the temperature dependence of the Debye-Waller factor obtained from Mossbauer experiments has been presented. Author (TAB)

N69-27046# AEG-Telefunken, Ulm (West Germany).
A SIMPLE NONDESTRUCTIVE METHOD OF MEASURING TRANSPARENT THIN FILMS BETWEEN 10 AND 600 nm [EINE EINFACHE ZERSTOERUNGSFREIE METHODE ZUR MESSUNG DURCHSICHTIGER DUENNER SCHICHTEN ZWISCHEN 10 UND 600 nm]
I. Fränz and W. Langheinrich Oct. 1968 25 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMwF-FB-W-68-71) Avail: CFSTI

A simple interferometric method is described for measuring the thickness of transparent layers deposited on a reflecting substrate by means of determining the intensity reflected through a microscope with a photoconductive cell. Both the incident and reflecting beam are led through the objective of a metal microscope, permitting examination of about 1mm^2 for cleanliness and homogeneity. The thickness can be read to within 10 nm from plots of the reflection function, e.g. for silicon dioxide and silicon nitride on silicon, and silicon dioxide on germanium. Author (ESRO)

N69-27047# AEG-Telefunken, Ulm (West Germany).
EXPERIMENTS CONCERNING THE DIFFUSION OF INDIUM IN GERMANIUM [VERSUCHE ZUR DIFFUSION VON INDIUM IN GERMANIUM]
M. Kuisl Oct. 1968 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMwF-FB-W-68-72) Avail: CFSTI

Doping of germanium with indium is shown to be possible by vapor deposition with the source being seperated from the substrate. Difficulties arising in the process such as surface pitting and thermal conversion could be eliminated. As silicon dioxide does not mask against indium, experiments were conducted with phosphate glass layers which proved to provide masking against indium. Author (ESRO)

N69-27082# AEG-Telefunken, Ulm (West Germany).
THE INFLUENCE OF IMPURITIES IN QUARTZ ON THE PURITY OF ANNEALED SEMICONDUCTOR SURFACES [EINFLUSS VON VERUNREINIGUNGEN VON QUARZ AUF DIE REINHEIT GEGLUEHTER HALBLEITEROBERFLAECHEN]
I. Fränz and W. Langheinrich Oct. 1968 23 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMwF-FB-W-68-69) Avail: CFSTI

It was shown that surface contaminations on silicon wafers detected by neutron activation analysis may have their origin in part in the quartz containers used in the production processes. Contaminations of new and used quartz glass were determined by means of neutron activation. Transfer of such contaminations from activated quartz containers to silicon wafers was investigated. Author (ESRO)

N69-27112# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Institut fuer Kernphysik.
A UNIVERSAL MONTE CARLO METHOD FOR SOLUTION OF ELECTRON TRANSPORT PROBLEMS
Siegmar Wittig Dec. 1968 69 p refs In GERMAN
(IKF-20) Avail: AEC Depository Libraries

A Monte Carlo program was written for the calculation of electron paths in matter. Multiple scattering, straggling of energy losses by ionization and excitation, and bremsstrahlung losses are taken into account. Range and path-length distributions are given for perpendicularly incident electrons in the range from 0.25 to 6 MeV for the absorbers polystyrene, graphite, aluminum, silicon, copper, germanium, silver, gold, and lead. Author (NSA)

N69-27118# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
THE DE HAAS-VAN ALPHEN EFFECT AND THE FERMI SURFACE OF THORIUM
David Joseph Boyle (Ph.D. Thesis) Nov. 1968 111 p refs
(Contract W-7405-eng-82)
(IS-T-261) Avail: CFSTI

The de Haas–van Alphen (dHvA) effect has been extensively studied in single crystals of thorium, using the field-modulation technique for magnetic fields of 62 kG and temperature of 1.1°K. The quasi-static fields were precisely determined by means of nuclear magnetic resonance, and the dHvA data were recorded digitally for frequency analysis by the periodogram method. The observed frequencies ranged from 2.0 to 25 MG, with the dominant terms in the 9.4-14 MG band. These results were then compared to the frequency variations arising from the Fermi surface proposed by Gupta and Loucks. The experimental observations of the dominant band were in good qualitative agreement with the electron-surface model of twelve butterfly-shaped pieces along the ⟨110⟩ directions. The hole surface suggested by the data consists of a quasispherical segment centered at the point Γ of the Brillouin zone, and of dumbell-shaped pieces with axes along the ⟨111⟩ directions and centered at the symmetry points L. Author (NSA)

N69-27120# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF A CRYSTAL AT ABSOLUTE ZERO
G. Ochirbat 13 Jun. 1968 15 p Refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. III: Fiz.-Astron. (Moscow), no. 3, 1967 p 7–14
(AD-683140; FTD-HT-23-345-68) Avail: CFSTI CSCL 20/2

Certain properties of a crystal at absolute zero are derived theoretically from a self-coordinated equation of quantum mechanics. Author (TAB)

N69-27138# Picatinny Arsenal, Dover, N.J. Feltman Research Labs.
CAPACITIVE EFFECTS IN AMORPHOUS CHALCOGENIDE THIN FILMS
R. Vogel and P. J. Walsh Dec. 1968 13 p refs
(AD-683467; PA-TR-3797) Avail: CFSTI CSCL 20/12

Certain amorphous materials exhibit rapid electrical switching. The variation in their capacitance was evaluated as a function of temperature and electric field. At zero bias, the capacitance of such materials follows a Curie-Weiss law. However, it decreases rapidly as the bias approaches the switching threshold and, under certain conditions, it shows negative values close to threshold as well as at low temperatures. Author (TAB)

N69-27148# Ohio State Univ. Research Foundation, Columbus.
LOW TEMPERATURE THERMAL EXPANSION OF WURTZITE-PHASES OF IIB-VIB COMPOUNDS. PART 2: THERMAL EXPANSION OF CdSe, CADMOSELITE, FROM 3° TO 380°K Final Report, 31 Jul. 1966–30 Jun. 1968
R. R. Reeber and D. McLachlan, Jr. Wright-Patterson AFB, Ohio ARL Nov. 1968 25 p refs
(Contract AF 33(615)-2270)
(AD-683355; ARL-68-0197) Avail: CFSTI CSCL 20/12

Thermal expansion measurements of the wurtzite phase of CdSe have been made using back reflection x-ray techniques. There is an apparent minimum of the molar volume in the temperature range 40 to 70K. Author (TAB)

N69-27182# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF POLARITY DETERMINATION IN SILICON CARBIDE STRUCTURE BY ETCHING METHOD
Chang-Lin Kuo 26 Aug. 1968 12 p refs Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 22, no. 7, 1966 p 831–835
(AD-683199; FTD-HT-23-1553-67) Avail: CFSTI CSCL 20/2

The authors describe their experiments on negative and positive c faces in silicon carbide. The authors conclude that the faces can be distinguished by observing the bluntness and sharpness of the edges occurring due to etching speed variation, and the positive c face is a carbon face and the negative one, a silicon face. TAB

N69-27242# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE PHASE TRANSITION IN SnTe BY MEANS OF THE MOSSBAUER EFFECT
V. V. Chekin, O.P. Balkashin, and G.D. Sultanov [1968] 5 p refs Transl. into ENGLISH from Ukr. Fiz. Zh (Kiev), v. 14, no. 1, 1969 p 102–105
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The temperature dependence of the probability of the Mossbauer effect in Sn^{119} nuclei of 90% SnTe and 10% GeTe alloys, characterized by a phase transition in the range of 110°K, was investigated (78 to 200°K temperature band). The temperature dependence of the probability determined corresponds to theoretical considerations on the ferroelectric phase transition at which the instability in crystal structure is explained by the strong temperature dependence of the low-frequency transverse optical branch of the phonon spectrum of the crystal. A comparison is made with experimental results for ferroelectrics of perovskite structure, whose complex composition or the need to add Mossbauer impurity atoms lead to results which differ from those expected. Isomeric shift measurements in Sn^{119} nuclei in different crystallographic phases of the 90% SnTe and 10% GeTe and SnTe samples doped with 8 to 10% Si and Pb showed that the shift is constant to ±0.05 mm/sec accuracy, which indicates a small contribution of the 5s - states of tin to the chemical binding. Author

N69-27366 Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
ELECTRON-INDUCED CONDUCTIVITY IN VAPOR-DEPOSITED FILMS OF ZnS [ELEKTRONENINDUZIERTE LEITFAEHIGKEIT IN ZnS-AUFDAMPFSCHICHTEN]
Virinder Singh Grewal (Ph.D. Thesis) 5 Feb. 1969 93 p refs In GERMAN
Avail: CFSTI

Vapor deposited zinc sulfide layers were exposed to electron bombardment and the developing conductivity was defined by measuring accelerated voltage, layer charge, layer thickness, and layer temperature. The high polarization voltage that induced conductivity was attributed to the formation of electron traps which decreased during long term heating of the layer. Transl. by G.G.

N69-27387# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE THEORY OF ELECTRICAL CONDUCTIVITY OF LIQUID METALS [ZUR THEORIE ELEKTRISCHEN LEITFAEHIGHKEIT FLUESSIGER METALLE]
Helmut Forberich (Ph.D. Thesis) 4 Mar. 1969 43 p refs In GERMAN
Avail: CFSTI

The linear response theory is used to develop a mathematical model for calculating the transport coefficient of electric conductivity in liquid metals. Electron mass in this model is expressed by a quasi particle mass and the electron-ion scattering amplitude by a normalized scattering amplitude. Dielectric constants and their response functions are determined through the proportional conductivity coefficient between current and effective macroscopic field in the metal; corrections are made for electron exchange reactions. Trans. by G.G.

N69-27419# Wake Forest Coll., Winston-Salem, N.C.
DISLOCATION-INTERSTITIAL INTERACTIONS IN SINGLE-CRYSTAL TANTALUM
Richard C. Sanders and Thomas J. Turner 23 Sep. 1968 16 p refs Presented at the Internatl. Conf. on Vacancies and Interstitials in Metals, Juelich, West Ger.
(ORO-2413-18-App-2; CONF-680910-8) Avail: CFSTI

The amplitude dependent (hysteretic) decrement of high purity single-crystal tantalum has been measured with a composite oscillator operating at approximately 50 kHz at 200 to 400°K. Linear Granato–Lücke plots were obtained whose slopes give a binding energy for oxygen to the dislocation of 0.025 eV. The appears unrealistic since it is smaller than kT for some temperatures employed. Assuming an Arrhenius temperature dependence for the hysteretic decrement a stress dependent binding energy was obtained. The data extrapolate to a zero stress binding energy of 0.27 eV and a maximum breakaway stress of 2.7×10^6 kg/m^2. A high temperature modification to the Granato–Lücke theory utilizing a force approach was found to be inadequate for this sytem. Author (NSA)

N69-27496# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHONON SPECTRA OF METALS [O FONONNOM SPEKTRE METALLOV]
E. G. Brovman and Yu. Kagan 7 Mar. 1968 41 p refs Transl. into ENGLISH from Russian Rept. AE-1186
(AD-683943; FTD-HT-23-1564-67) Avail: CFSTI CSCL 20/2

Contents: Validity of the adiabatic approximation in metals; Determination of electron energy; Effective interionic interaction in a metal; Dynamic vibration matrix for phonons in a metal; Vibration spectrum of tin ionic lattice; Phonon spectrum of metallic tin; Role of long-range and short-range forces in producing the phonon spectrum of tin. TAB

N69-27532# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL CONDUCTIVITY OF SOLID OXIDES. XI: LANTHANUM OXIDE–CALCIUM OXIDE SYSTEM
S. F. Palguev et al 26 Jul. 1968 14 p refs Transl. into ENGLISH from Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural'sk. Filial (Sverdlovsk), no. 9, 1966 p 133–138
(AD-683194; FTD-HT-23-87-68) Avail: CFSTI CSCL 20/12

In view of the previously investigated electrical conductivity of a solid solution with the fluorite-type lattice, the subject of this study was to determine the effect of the change of the crystal structure of the electrolyte on electrical conductivity. For this purpose the La2O3-CaO system was investigated. In addition, two specimens of the La2O3 + BeO and La2O3 + MgO systems were also investigated since these systems do not form solid solutions. The electrical conductivity measurements were carried out by the EMF method. The nature of the electrical conductivity was investigated under various conditions. In one case the solid electrolyte was placed in contact with gas atmospheres containing high partial pressure of oxygen and in the second case a gas mixture containing very low partial pressure of oxygen was fed to the electrode. The transport numbers of ions were measured by the modified gravimetric method. The results of the measurements show that even small additions of calcium oxide cause a significant increase in the electrical conductivity of lanthanum oxide. The increase in the conductivity upon further addition of calcium oxide is less pronounced. Author (TAB)

N69-27545# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF SOME LATTICE DEFECTS WITH HELP OF CHANNELED α PARTICLES [ETUDE QUELQUES DEFAULTS CRISTALLINS A L AIDE DE PARTICULES α CANALISEES]
Yves Quere (Ph.D. Thesis—Paris Univ., Orsay) 1968 75 p refs In FRENCH
(CEA-R-3606) Avail: AEC Depository Libraries

A method is described in which a metallic foil is irradiated by isotropic α particles. The thickness of the foil is such that only channeled particles can traverse it. The emerging flux, a function of the local concentration of defects, falls on a collector where an image of the foil is formed. The influence of grain or twin boundaries, of stacking faults, of dislocations, is observed. A quantitative study of dislocation is presented. The effect of a dislocation is represented by the presence of a coaxial dechanneling cylinder of diameter: $\lambda = (b\ d\ a\ E/\alpha Z_1 Z_2 e^2)^{1/2}$, where b is the Burgers vector; d the interatomic distance along the channel; a the screening radius of the interaction between the particles (Z_2) and the metal (Z_1); E the energy of the particles; α a numerical parameter. Channeling patterns, observed in all metals, are described. They are more numerous if the metal has been treated some time in gaseous atmospheres. They correspond to zones, on the metal, situated on the side of entrance of particles. Author (NSA)

N69-27550# Commissariat d l'Energie Atomique, Grenoble (France).
STUDY OF STAGE 1 IN IRRADIATED NICKEL
G. deKeating-Hart, R. Cope, C. Minier, and P. Moser [1968] 17 p refs Presented at the Conf. on the Phys. of Metals, Berlin, 18-23 Mar. 1968
(CEA-CONF-1029; CONF-680322-3) Avail: AEC Depository Libraries

The fine structure in the resistivity recovery curve of electron-irradiated single-crystal Ni and the effects of the beam direction ⟨100⟩, ⟨110⟩, and ⟨111⟩) on the recovery I peaks were studied. Internal friction measurements were also done after irradiations with neutrons at 28°K and electrons at 20°K, with and without magnetic field. The internal friction results are correlated with the resistivity and magnetic after-effect. An attempt is made to identify the different stages, and a close-pair model is proposed. NSA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-28151# Western Co. of North America, Richardson, Tex. Research Div.
INVESTIGATION OF MODIFIED TURBINE FUELS FOR REDUCTION OF CRASH FIRE HAZARD
Ken Posey, Jr. May 1969 36 p refs
(Contract FA68NF-269)
(NA-69-10) Avail: Issuing Activity

Fifty-five modified fuels were tested and rated for their ability to reduce aircraft post-crash fires. The candidate fuels were subjected to a seven-part rating scheme in which combustion and physical properties were examined under both static and dynamic conditions. Measurements were made of flash point, rate of vapor release, burn rate, surface flame propagation rate and fuel spread rate (ignited), as well as fireball size under impact conditions (drop test) and fireball size with sample propelled by a catapult device. Fuels gelled with either alkyl-hydroxybutyramides, amine diisocyanates, aluminum octoate or a styrene-type polymer as well as an emulsified fuel were found to provide marked safety benefits. The alkyl-hydroxybutyramide gels, the amine diisocyonates, and the emulsion had a firm, or stiff, consistency which would present a serious tank feed-down problem in present aircraft. The polymer gel was pourable but contained harmful sodium and required a relatively high polymer concentration, and the polymer was not compatible with the de-icer contained in JP-4. The aluminum octate gel was selected as the best of the candidate fuels tested. Author

N69-28298# Explosives Research and Development Establishment, Waltham Abbey (England).
THE TENSILE PROPERTIES OF A POLYURETHANE PROPELLANT, UP 2
R. W. Bryant and W. A. Dukes 20 Dec. 1968 28 p ref
(AD-683183; ERDE-22/R/68) Avail: CFSTI CSCL 21/8.2

A sample of a polyurethane propellant, designated UP 2, has been characterised in uniaxial tension using time-temperature superposition principles, over wider ranges of strain-rate and temperature than have been used previously. Near the embrittlement temperature the true strain (photographically determined) rapidly becomes much less than the nominal strain. Consideration of nominal

strains can thus be misleading. Under the conditions of rocket ignition at low temperatures the true strain is rapidly decreasing, and the true modulus increasing, with decreasing temperature. Author (TAB)

N69-26442*# National Bureau of Standards, Washington, D.C.
PREPARATION AND CHARACTERIZATION OF SLUSH HYDROGEN AND NITROGEN GELS
A. S. Rapial and D. E. Daney May 1969 45 p refs Sponsored jointly by NASA, Intern. Atomic Energy Agency, and Colorado Univ.
(NASA-CR-101082, NBS-TN-378) Avail: SOD $0.50; CFSTI CSCL 21I

An experimental apparatus was developed for the gelation of slush hydrogen. Measurements of the weight-bearing capacity of the gel as a function of mass percent gelant were made for liquid and slush nitrogen and hydrogen. These measurements verify the simple models discussed for gelled liquid and slush within the experimental accuracy; the models predict a reduction in gelant concentration from 38 mass percent to 25 mass percent in going from normal boiling point liquid hydrogen to slush hydrogen of 0.40 solid fraction for the silica gelant used. Reduction in the mass percent gelant for other gelants should be similar. Author

N69-26587# Naval Ordnance Lab., White Oak, Md.
IDEAL DETONATION VELOCITY OF AMMONIUM PERCHLORATE AND ITS MIXTURES WITH H.E.
D. Price, A. R. Clairmont, Jr., J. O. Erkman, and D. J. Edwards 16 Dec. 1968 53 p refs
(AD-683298; NOLTR-68-182) Avail: CFSTI CSCL 19/1

Detonation velocity measurements were made on AP/H.E. mixtures containing 20% of HMX, PETN, and TNETB. They indicated an oxidation-reduction reaction for AP/HMX only. The AP in the other two mixtures contributed to the detonation velocity, but the additivity rule does not seem applicable to mixtures of AP with organic H.E. Author (TAB)

N69-26942 Texas Univ., Austin.
A HYPERVELOCITY LAUNCHER USING AN INTERNAL PROPELLANT LINING
Charles Alvard Rodenberger (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-16129

The concept investigated is one in which a projectile is accelerated through a launch tube by lining the inside of the launch tube with a thin explosive liner. As the projectile travels down the tube it ignites the explosive lining, releasing a high pressure gas which is used to maintain pressure on the base of the projectile. Experimental evaluations of the technique resulted in increasing the velocity of a projectile to 7800 feet per second. A simplified theoretical analysis of the equation of motion related to the concept indicates that the upper limitations to velocities of projectiles can be increased. The theory also indicates that the attainment of hypervelocities will require that ignition and reaction of the propellant lining occur in a few microseconds. Experiments indicated that such short times could be obtained. Experimental techniques were developed to coat the inside of long tubes with thin layers of explosive propellants. Dissert. Abstr.

N69-27184*# Bureau of Mines, Pittsburgh, Pa.
PREVENTION AND EXTINGUISHMENT OF FIRES INVOLVING HYPERGOLIC PROPELLANTS Final Report
D. S. Burgess, T. A. Christos, J. C. Cooper, T. A. Kubala, G. H. Martindill et al 31 Oct. 1968 65 p refs
(NASA Order-CC-69100)
(NASA-CR-101226; FR-4053) Avail: CFSTI CSCL 21I

The likely effectiveness of a proposed Halon 1301 system for inerting the atmosphere of the spacecraft LM adapter was investigated, as to the extent of protection afforded by Halon 1301 alone against Aerozine-50 spills and fires, and as to the ways in which water of CO_2 could be used along with it for improved protection. The results of ten study tasks are reported. It is concluded that: (1) the propellant Aerozine-50 poses severe fire and explosion hazards unless unusual measures are taken for inerting and for fire extinguishment; (2) water is the only agent effective in all aspects of inerting and extinguishment studied; (3) Halon 1301 provides a valuable possibility of preventing A-50 fires by inerting but cannot be depended upon to extinguish an A-50 fire because of the high concentrations that would be required; (4) no useful inerting or extinguishment technique is found based on either the mildly exothermic reaction of CO_2 with A-50 or on the endothermic replacement reactions of ammonium salts with A-50. P.A.B.

N69-27586# California Univ., Livermore. Lawrence Radiation Lab.
A NEW POLYESTER-POLYETHER BINDER FOR EXTRUSION-CAST EXPLOSIVES
Eugene R. Bissell 5 Nov. 1968 9 p Supported by AEC
(UCRL-50541) Avail: CFSTI

A binder for extrusion-cast explosives with the composition 70/19/7.2/3.o-bis(fluorodinitroethyl) formal–epoxide B–maleic anhydride–diethylene glycol was developed. Relative reactivities of a number of organometallic catalysts for the polymerization reaction are reported. Author (NSA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-26182# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING THE DIAMETERS OF ENGINE EXHAUST LINES FOR THE CASE OF AN IMPULSE SUPERCHARGER SYSTEM
M. G. Kruglov et al 23 Aug. 1968 13 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zaved Enii, Mashinostr. (Moscow), no. 8, 1967 p 74–78
(AD-683127; FTD-HT-23-486-68) Avail: CFSTI CSCL 21/5

A method is proposed for determining the exhaust pipe diameter which gives minimum gas energy losses in a high-speed two-stroke engine with exhaust turbine. Analysis of experimental data on the operation of these engines shows that the principal losses in the exhaust system are those due to sudden expansion as the gas flows through the valves into the manifold, and those in the exhaust line itself. Other losses due to localized resistances besides those in the valves may be accounted for by including them in the equivalent length of the exhaust line. Heat leakage through the walls of the line is small and may be disregarded. Thus the problem reduces to finding the exhaust pipe diameter which gives minimum hydraulic losses in the exhaust valves and line for given values of cyclic mass flow, tubing length and effective cross sectional area of the exhaust valves. The procedure is based on derivation of an expression for the gas energy lost in terms of the coefficient of localized drag, the drag coefficient with respect to length, the dimensions of the tubing, and the density of gas. This formula is derived by integrating the expression for the element of energy loss with respect to time from the instant when the gas

leaves the cylinder to the instant when the gas leaves the exhaust line. Numerical analysis of this expression shows that deviation from optimum toward smaller diameters causes a more rapid increase in losses than when the diameter is increased past optimum. Thus if it becomes necessary for some reason to use tubing which differs from the optimum size, it is better to use a larger size. Author (TAB)

N69-26191*# Arde-Portland, Inc., Paramus, N. J.
DESIGN, FABRICATION AND EVALUATION OF TUNGSTEN ENCAPSULATED SILVER INFILTRATED POROUS TUNGSTEN ROCKET NOZZLE INSERTS Final Report
Joseph Price [1969] 70 p refs
(Contract NAS1-4722)
(NASA-CR-66759) Avail: CFSTI CSCL 21H

Evaluation of a self cooled rocket nozzle concept consisting of a silver impregnated tungsten throat insert designed to cool by evaporation of the silver coolant was performed. The concept involves encapsulating a nozzle throat insert in a solid tungsten case with preselected vent regions to control the silver evaporation. The reasoning leading to the concept is reviewed. The design, fabrication and testing of five experimental inserts are described. Two test inserts were unencapsulated and served as comparative controls to evaluate the performance of three encapsulated inserts. The encapsulated inserts differed from each other with respect to the encapsulation techniques used and/or the design of the coolant venting system. Author

N69-26200# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EJECTOR WITH NOZZLE PERFORATED WITH LONGITUDINAL SLITS
Yu. K. Arkadov 14 Nov. 1968 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhid. Gaza (USSR), no. 6, 1967 p 71–74
(AD-683992; FTD-MT-24-389-68) Avail: CFSTI CSCL 21/7

The possibility is considered of changing conditions of cutoff of a supersonic gas ejector by installing in the initial section of mixing chamber a cylindrical wall perforated with longitudinal slits. This wall is the continuation of the high-pressure nozzle. A diagram of ejector and results of experimental investigation of a series of ejectors with different permeability coefficients of perforated wall are given. Comparison with ejector of classical layout is made, showing that in a number of regimes characteristics of ejector can be improved several times. Author (TAB)

N69-26224*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
INVESTIGATION OF SA-501 S-IVB AUXILIARY
K. Coates and E. Donald
Washington May 1969 46 p
(NASA-TN-D-5207) Avail: CFSTI CSCL 21E

Several anomalies which occurred on the S-IVB auxiliary propulsion system during the SA-501 flight are reported. The anomalies of primary significance were low chamber pressure for several engines beginning at the start of the S-IVB powered flight and high propellant temperatures experienced late in flight. An investigation of possible causes by theoretical analysis and hardware testing was conducted by MSFC. The analyses indicated that the high propellant temperature was caused by a degradation of the Auxiliary Propulsion System (APS) module surface paint thermal properties, which in turn was caused by S-II stage retro-rocket exhaust gas plume impingement. The cause of the anomalous chamber pressures of several engines at the beginning of S-IVB powered flight was verified by testing to be contamination of the engine injector because of burp firing at ambient conditions at KSC. The investigation resulted in the deletion of the burp firing requirement prior to launch at KSC and in modification to the APS hardware to prevent the temperature rise of the propellant. Author

N69-26227# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD FOR DETERMINING THE ECONOMIC EFFECTIVENESS OF GAS TURBINE UNIT SYSTEMS WITH THE CONSIDERATION OF OPTIMUM PARAMETERS
F. T. Markovskii and A. F. Usik 6 Sep. 1969 14 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 3, 1968 p 61–67
(AD-683130; FTD-HT-23-343-68) Avail: CFSTI CSCL 21/5

A method for determining the economic effectiveness of nonregenerative gas turbine units (GTU) was developed (with consideration of the thermodynamic and engineering-economic characteristics). This method was formulated for gas turbine units which operate at rated power (for generating electricity). The costs are expressed as functions of thermodynamic parameters and economic operating conditions. The optimum combination of thermodynamic properties is determined first. Various considerations involved in designing units using expensive fuel for long periods are discussed for the case when maximum operating efficiency is the main concern. For peak units running on cheap fuel, the importance of other factors increases. When the parameters are interdependent, the problem is solved by the method of Lagrange factors; when the parameters are independent, a system of partial differential equations must be solved. Balance equations for gas turbine unit shaft operations and for compression ratios are used to reduce the interdependency of parameters and to utilize the latter method. Compression ratios affecting the investment and operating costs are studied in detail. The calculated costs are found to agree well with actual costs. A final expression is obtained for annual costs in terms of the gas turbine unit parameters. Author (TAB)

N69-26229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF REGENERATION IN CYCLES USING WORKING MEDIA WITH VARIABLE SPECIFIC HEAT
M. A. Bazhin, V. P. Bubnov, and V. B. Nesterenko 22 Nov. 1968 10 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekh. Navuk (Minsk), no. 4, 1968 p 23–26
(AD-683966; FTD-HT-23-1000-68) Avail: CFSTI CSCL 21/5

In view of recent proposals to use chemically reacting gas systems as working media in gas turbines, earlier research was continued on regenerative turbine cycles. It was shown that regeneration of heat can make a major contribution to the efficiency of the system. Calculations are presented for both uniflow and counter-flow systems, with account taken of the variation in the specific heat of the gas as a result of the chemical reactions that take place in it. The calculations are made on the basis of the heat balance equation for the heating and heated sides of the regenerating equipment, with allowance for the fact that in the case of variable specific heat the temperature differential within the system (relative to one of the terminal points of the regenerator) can occur not only on the ends of the interval of variation of the the independent variable (as is the case for gases with constant specific heat) but also inside the interval. The conditions under which maxima occur inside the interval are determined for both the uniflow and counter flow cases. The calculations demonstrate that allowance for the variable specific heat alters the heat-balance calculations significantly. Author (TAB)

N69-26436*# Hercules Inc., Magna, Utah. Chemical Propulsion Div.
SCOUT STANDARD 5th STAGE BE-3-A5 ROCKET MOTOR PROPULSION UNIT PROGRAM Final Report

D. R. Robertson 20 May 1969 205 p refs
(Contract NAS1-7102)
(NASA-CR-66773; H214-12-4-10) Avail: CFSTI CSCL 21H

The principal activity of the BE-3-A9 program consisted of adapting a previously developed BE-3 rocket motor for use as the Scout 5th Stage motor. This included modifying interface points, igniter initiation system, and conducting an extensive series of tests to assure that the BE-3-A9 rocket motor would perform successfully within the Scout vehicle operating environment. Nine live motors, one inert motor, and one mockup motor were produced. Six of the live motors were for flight, two were static spin fired, and one was environmentally tested and static diffuser fired. Author

N69-26520# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SECOND GENERATION GAS TURBINE ENGINES. DISCUSSION OF TURBOFAN ENGINES
Hsiao Ling 23 Aug. 1968 11 p refs Transl. of Hang K'ung Chih Shih (Mainland China), v. 1, no. 10, 1964 p 16–18
(AD-683118; FTD-HT-23-858-67) Avail: CFSTI CSCL 21/5

Turbojet aircraft fly at a speed exceeding 2000 km/hr and have a higher rate of fuel consumption. Mig-15 and Tu-104 aircraft powered by turbojet engines have a fuel consumption rate of 0.8-1.0 kg per 1-kg thrust per hr. Turboprop engines were developed for the purpose of fuel economy. Turboprop engines have similar construction and operate on the same principle as a turbojet engine. The only difference in a turboprop engine is the addition of a propeller outside the compressor. Turboprop engines are built for long-range civil transport airplanes flying at a speed of 800-900 km/hr. Turboprop engines can also be used in military aircraft having a flying speed of 4-4.5 mach if an afterburner is added. Tests showed that the fuel consumption of turboprop engines is reduced 16-20% under the same internal flow condition. Takeoff thrust is also increased 30-40% and engine noise is reduced 10-15 db. Turboprop engines, however, are more complicated in construction, heavier, and larger in diameter (30-40%) than turbojet engines. More than 40 types of turboprop engines have been developed recently. A small turboprop engine capable of producing a thrust of only 300 kg is in process of development. A large turboprop engine having a thrust of 9000-10000 kg and a fuel consumption rate of 0.51-0.54 kg per 1-kg thrust per hr has been developed. Middle-range Tu-124 passenger airplanes powered by turboprop engines have a fuel consumption rate 15-25% lower than Tu-104 airplanes. Author (TAB)

N69-26526# Advisory Group for Aerospace Research and Development, Paris (France).
ADVANCED COMPONENTS FOR TURBOJET ENGINES, PART 2
Sep. 1968 277 p refs In ENGLISH and FRENCH Presented at the 32d Meeting of the Propulsion and Energetics Panel of AGARD, Toulouse, 9–13 Sep. 1968
(AGARD-CP-34-PT-2) Avail: CFSTI

CONTENTS:

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2. HIGH INTENSITY COMBUSTION: SOME THOUGHTS ON ITS ATTAINMENT WITHIN AIRCRAFT GAS TURBINE COMBUSTION CHAMBERS J. Odgers (Lucas Gas Turbine Equip.) 17 p refs (See N69-26528 14-33)

3. ON THE BRUNING LIMITS OF FLAME HOLDER-STABILIZER FLAMES IN SUPERSONIC FLOW G. Winterfeld (DVL, Porz, West Germ.) 15 p refs (See N69-26529 14-33)

4. MEASUREMENTS OF IGNITION DELAYS OF HYDROGEN AIR MIXTURES UNDER SIMULATED CONDITIONS OF SUPERSONIC COMBUSTION CHAMBERS F. S. Just (DVL, Porz, West Ger.) 16 p refs (See N69-26530 14-33)

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6. AERODYNAMIC PROBLEMS IN COOLED TURBINE BLADING DESIGN FOR SMALL GAS TURBINE L. Burrows (Army Aviation Mater. Labs.), J. Chauvin, and K. Papailiou (Von Karman Inst. for Fluid Dyn.) 22 p refs (See N69-26532 14-03)

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8. NOZZLE OPTIMIZATION PROBLEMS J. M. Hardy (Soc. Natl. d Etude et de Construct. de Moteurs d Aviation, Villaroche, France), P. Carriere, and M. Sirieix (Office Natl. d Etudes et de Rech. Aerospatiales) 24 p refs (See N69-26534 14-12)

9. SUPERSONIC NOZZLES J. J. Horgan and D. B. Waring (Pratt and Whitney Aircraft, East Hartford, Conn.) 13 p refs (See N69-26535 14-28)

10. THE EFFECT ON OUTPUT OF REHEATING TURBOREACTORS INTENDED FOR SUPERSONIC PLANES L. Bauger (Soc. Natl. d Etude et de Construt. de Moteurs d Aviation, Paris) 18 p (See N69-26536 14-28)

11. A CONTRIBUTION TO THE TURBULENT MIXING OF TWO PARALLEL STREAMS INSIDE A MIXING CHAMBER A. Homburg 14 p refs (See N69-26537 14-12)

12. MIXING REGIMES OF TWO STREAMS WITH DIFFERENT TOTAL ENTHALPIES E. Le Grives (Office Natl. d Etudes et de Rech. Aerospatiales) 13 p refs (See N69-26538 14-28)

13. THE DYNAMIC BEHAVIOUR OF JET ENGINES UNDER EXTERNAL AND INTERNAL ACTION F. Fett (Tech. Hochschule Aachen) 14 p refs (See N69-26539 12-28)

14. A NEW METHOD FOR THE DETERMINATION OF TRANSIENT JET ENGINE PERFORMANCE BASED ON THE NONSTATIONARY CHARACTERISTICS OF THE COMPONENTS K. Bauerfeind (MAN-Turbomotoren G.m.b.H.) 26 p refs (See N69-26540 14-28)

N69-26535# Pratt and Whitney Aircraft, East Hartford, Conn.
SUPERSONIC NOZZLES
J. J. Horgan and D. B. Waring *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 13 p refs (See N69-26528 14-28)
Avail: CFSTI

To maximize nozzle performance, the internal contours must be carefully selected to provide efficient expansion over the entire flight spectrum. These contours must also blend smoothly into the external surfaces of the airplane fuselage. The in-flight flow field behavior in the region surrounding the exhaust nozzle will normally be influenced to varying degrees by the characteristics of the exhaust plume. Many of the best nozzle concepts are designed so that the exhaust flow undergoes aerodynamic adjustment to local back pressures. This minimizes internal over or under expansion losses; however, it permits the exhaust flow to adjust to the local airframe induced pressure field. Since this external flow field is also influenced by the nozzle exhaust plume, there is communication between external airplane flow and the engine jet flow in the exhaust nozzle. The task of minimizing the drag on the external nozzle surfaces and surrounding airplane fuselage surfaces is greatly complicated by the magnitude and nature of this communication. The development is reviewed of supersonic exhaust systems, wind tunnel tests of exhaust systems alone (isolated) and in twin-jet fuselage-mounted testing (installed). Based on available unclassified data from model testing and full scale flight tests, several attractive nozzle types are discussed. Author

N69-26536# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France). Avant-Projets.

THE EFFECT ON OUTPUT OF REHEATING TURBOREACTORS INTENDED FOR SUPERSONIC PLANES [L'IMPORTANCE DU RENDEMENT DE LA RECHAUFFE DES TURBOREACTEURS DESTINES A LA MOTORISATION D'AVIONS SUPERSONIQUES]

L. Bauger *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 18 p In FRENCH (See N69-26526 14-28)

Avail: CFSTI

The importance of reheating on the propulsion efficiency of supersonic civilian transports is discussed. The reheating apparatus and an analysis of the output of reheated propulsion are considered. Propulsive yield is the product of three specific elementary efficiencies of reheating: isentropic yield of the cycle; combustion efficiency in the combustor; and isentropic efficiency of expansion in the ejection nozzle. Also indicated is the effect of stator blades in the reheating duct on increasing the output of the expansion gas cycle in an adapted convergent-divergent nozzle. Transl. by B.P.

N69-26538# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

MIXING REGIMES OF TWO STREAMS WITH DIFFERENT TOTAL ENTHALPIES [REGIMES DE MELANGE DE DEUX FLUX D'ENTHALPIES D'ARRET DIFFERENTES]

Emile Le Grives *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 13 p refs In FRENCH; ENGLISH summary (See N69-26526 14-28)

Avail: CFSTI

Analysis of the various regimes of mixing of coaxial fluxes such as occur in a variety of jet engines can be based on the aerodynamical theory of ejectors, which shows the requirements for compatibility of two streams flowing in the same duct. The basic modes of coexistence should be identified in view of practical effects such as thermal stresses, or performance instabilities and limitations in air-breathing thrusters. One dimensional analysis leads to a satisfactory description of the supersonic regime, when the primary stream expansion controls the mass flow rate of a subsonic secondary stream, or of the mixed flow with or without downstream choking. A set-up including an arc-heater fed with air was used for experimental research on downstream choking. Theoretical predictions are checked accurately for moderately long mixing tubes. Author

N69-26539# Technische Hochschule Aachen (West Germany). Institut Fuer Strahlantriebe und Turboarbeitsmachinen.

THE DYNAMIC BEHAVIOUR OF JET ENGINES UNDER EXTERNAL AND INTERNAL ACTION

F. Fett

In AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 (See N69-26526 14-28) 14 p refs

Avail: CFSTI

A method of calculation based on the linear theory is shown which permits the investigation of the transient characteristics of any type of propulsion unit. In particular, the method permits the determination of any action exceeding the manipulated variables which are taken into account in normal dynamic behaviour. Thus, in VTOL engineering the jet engines were partly given additional duties or subjected to disturbances, for which they had not been originally designed. The design and the possibilities offered by this method of investigation will be shown in detail and illustrated for different designs of propulsion units by several examples. The results of the theoretical investigations are compared with those of the experiments in the example of heavy air bleeding. In addition, the measured unsteady temperature distribution in the turbine blades is presented. Author

N69-26540# MAN-Jurbomotoren G.m.b.H., Munich (West Germany).

A NEW METHOD FOR THE DETERMINATION OF TRANSIENT JET ENGINE PERFORMANCE BASED ON THE NON-STATIONARY CHARACTERISTICS OF THE COMPONENTS

K. Bauerfeind

IN AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 (See N69-26526 14-28) 26 p refs

Avail: CFSTI

Present calculation methods for the evaluation of transient jet engine performance can be improved through a fuller consideration of the physical principles involved and the use of electronic computers to establish methods not only for a limited number of special cases but for the simulation of all possible transients. Three transient effects must be taken into account. They are heat exchange between gas and material, packing lags due to the filling up of volumes, and transient combustion phenomena. These effects were built into a computer program in an approximated form. A comparison between calculated and tested transient performance shows very good agreement. With this program a parametric study was carried out highlighting the most important components and their influence on transient engine performance. The study also shows that certain aspects of present control systems should be improved. Author

N69-26543*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

SENSITIVITY OF SUBSONIC TRANSPORT RANGE TO TURBOFAN ENGINE DESIGN

Robert W. Koenig and Laurence H. Fishbach Apr. 1969 19 p refs

(NASA-TM-X-52603) Avail: CFSTI CSCL 21E

In support of the NASA Quiet Engine Program, the range of a DC-8-61 type airplane was calculated for turbofan engines with a variety of turbine-inlet temperatures, overall compressor pressure ratios, and bypass ratios. Appropriate values for engine weight and size and installation drag and weight were used. Two-and three-spool engines were considered. No off-design analyses were made. Author

N69-26567# Boeing Co., Seattle, Wash. Missile and Information Systems Div.

THRUST COEFFICIENTS, THRUST DEFLECTION ANGLES, AND NONDIMENSIONAL MOMENTS FOR NOZZLES WITH OBLIQUE EXIT PLANES

William W. Phillips, Ross A. Fiedler, and Robert G. Hopcroft Mar. 1968 468 p ref

(AD-683763; D2-125619-1) Avail: CFSTI CSCL 21/8

Nozzles with oblique exit planes, scarfed nozzles, are encountered in aerospace applications such as reaction control and thrust reversal systems. This document provides thrust coefficient, thrust deflection angle, and nondimensional turning moment data for scarfed conical nozzles on machine-generated graphs. Based on one-dimensional isentropic flow of a perfect gas, the data cover specific heat ratios from 1.18 to 1.40, nozzle half-angles from 5 to 25 degrees, scarf angles from 10 to 90 degrees, area ratios at the upstream scarf point from 1.5 to 15, and ratios of chamber pressure to ambient pressure from 20 to infinity (vacuum). Author (TAB)

N69-26708*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF EFFECTS OF SIMULATED NUCLEAR RADIATION HEATING ON INDUCER PERFORMANCE IN LIQUID HYDROGEN

Phillip R. Meng and Robert E. Connelly Washington Feb. 1967 19 p refs
(NASA-TM-X-1359) Avail: CFSTI CSCL 21F

The performance of a constant-lead axial-flow inducer operating in liquid hydrogen with simulated radiation heating of a section of the inlet line was determined. An electrical heater was used to simulate a nonuniform mode of nuclear radiation heating which resulted in a nonequilibrium condition of vapor and liquid at the pump inlet. The inducer performance was observed over a range of flow from 1000 to 1500 gallons per minute with a constant speed of 20,000 rpm at heat input levels from 6.5 to 19 Btu per second. The two-phase flow, which resulted from nonuniform heating of the fluid caused a decrease in inducer cavitation performance. This decrease in performance resulted from an increase in the effective flow coefficient at the pump inlet due to the presence of vapor. When the inlet flow coefficient was adjusted to account for the quality of vapor, the inducer cavitation performance corresponded closely to the performance obtained with an unheated inlet line. Author

N69-26815# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN AND EVALUATION OF A HIGH TEMPERATURE RADIAL TURBINE Quarterly Technical Summary Report, 1 Nov. 1968–31 Jan. 1969
G. S. Calvert 15 Feb. 1969 19 p
(Contract DAAJ02-68-C-0003)
(AD-683505; QSR-6) Avail: CFSTI CSCL 21/5

A brief review of hot tests is given, and the fabrication status of the test rig is noted. TAB

N69-26990# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON DEMONSTRATION OF RELIABILITY LEVEL OF AIRCRAFT GAS TURBINE ENGINES
S. A. Mirzoyan et al 16 Jul. 1968 16 p Transl. into ENGLISH from Standarty i Kachestvo (USSR), no. 4, 1967 p 43–47
(AD-683229; FTD-MT-24-170-68) Avail: CFSTI CSCL 21/5

The article describes suggested techniques for determining the optimum reliability level of an aircraft jet engine. The techniques are characterized by the value of faultless service probability within a given time period, and it takes into account the costs of design, production and maintenance. Author (TAB)

N69-27019*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE AND STALL LIMITS OF A YTF30-P-1 TURBOFAN ENGINE WITH UNIFORM INLET FLOW
Willis M. Braithwaite and William R. Vollmar
Washington Jun. 1969 38 p refs
(NASA-TM-X-1803) Avail: CFSTI CSCL 21H

Performance and operating limits with uniform compressor inlet flow at a Reynolds number index of 0.5 are presented for a YTF30-P-1 (serial number P-847218) two-spool turbofan engine. A description is also included of the high frequency pressure measurement system developed and the techniques used in this investigation. Results are presented in the form of compressor maps, stall lines, bypass ratio, rotor speed match, and typical time histories. Author

N69-27071# Stanford Univ., California. Plasma Gasdynamics Lab.
ELECTRODE TEMPERATURE EFFECT ON MHD GENERATOR PERFORMANCE
R. H. Eustis, M. Mitchner, and C. H. Kruger Wright-Patterson AFB, Ohio AFAPL Jan. 1969 63 p refs
(Contract F33615-67-C-1127)
(AD-683793; SU-IPR-274; AFAPL-TR-68-141) Avail: CFSTI CSCL 10/2

Five segmented electrode pairs capable of controlled temperatures between 700K and 1700K were mounted at the downstream end of the MHD channel. The temperature of the electrode wall upstream of the electrode was controlled at two values, 750K and 2400K. By means of probes mounted in the sidewall, it was possible to measure the voltage drop at the electrodes due to the combined boundary layer and surface-sheath effects. Results showed that hot electrodes performed considerably better than cold electrodes and that anode voltage losses were largely due to boundary-layer losses while cathode losses were caused by boundary-layer and surface-sheath effects. Computer calculations were made to show the effect of electrode size for three types of gas conductivity profiles corresponding to no thermal boundary-layer and, cold and hot boundary-layers. Spectroscopic measurements of the boundary-layer temperature showed that the profile could be represented by a power-law enthalpy profile with the exponent equal to 1/6. An experiment was made to determine if finite recombination rates had a significant effect in combustion MHD generators. Techniques were investigated for measuring electron temperature and number density in combustion gas plasmas. Author (TAB)

N69-27197# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF SOLID FUEL ROCKET ENGINES
Ya. M. Shapiro et al 26 Feb. 1968 238 p refs Transl. into ENGLISH of the book "Teoriya Raketnogo Dvigatelya na Tverdom Toplivye" Moscow, Voyennoye Izd., 1966 p 1–256
(AD-684023; FTD-MT-24-384-67) Avail: CFSTI CSCL 21/8.2

This is a basic text on rocket fuels intended for specialists and engineers. Basic data is drawn from U. S. rocket technology. Covered in the text are: (1) basic fundamentals of rocket fuels, composition, caloricity; (2) progressive burn characteristics; (3) gas flow equations, pressure characteristics; (4) engine tuning; (5) heat shielding; and (6) thrust chamber and atmospheric dependences. Author (TAB)

N69-27411*# Pratt and Whitney Aircraft, West Palm Beach, Fla.
DEVELOPMENT OF AN ADVANCED ANNULAR COMBUSTOR Final Report, 30 Jun. 1966-24 Apr. 1968
J. P. Rusnak and J. H. Shadowen 30 May 1969 220 p refs
(Contract NAS3-9403)
(NASA-CR-72453; PWA-FR-2832) Avail: CFSTI CSCL 21H

The objective was to determine the structural durability of a full-scale advanced turbojet combustor operating at conditions typical of advanced supersonic aircraft. A full-scale annular combustor of the ram-induction type was fabricated and subjected to a 325-hour cycle endurance test at conditions representative of operation in a Mach 3.0 aircraft. The combustor exhibited extensive cracking and scoop burning at the end of the test program. But these defects had no appreciable effect on combustor performance, as performance remained at a high level throughout the endurance program. Most performance goals were achieved with pressure loss values near 6% and 8%, and temperature rise variation ratio values near 1.25 and 1.22 at takeoff and cruise conditions, respectively. Combustion efficiencies approached 100% and the exit radial temperature profiles were approximately as desired. Author

N69-27416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SURVEY OF MODERN AIRCRAFT POWERPLANTS

Ting Fu 23 Aug. 1968 10 p Transl. into ENGLISH from Hang Kung Chih Shih (Communist China), v. 2, no. 5, 1965 p 7–9
(AD-683164; FTD-HT-23-859-67) Avail: CFSTI CSCL 21/5

The author points out that the turbo-jet engine can no longer satisfy the demands of the modern world; he therefore describes briefly the various types of engines under study at present in certain countries. These fall into two main categories: (1) Supersonic aircraft engines, which include a turbo-fan after-burner engine, a turbo-fan ram-jet combination, and a turbo-rocket engine. (2) VTOL jet engines which do not need long runways, including a turbo-jet lift engine, a turbo-fan lift engine, a conventional turbo-jet engine with a lift fan attachment, and a deflected lift engine. A reheating gas turbine engine which has the advantage of a low fuel requirement is also briefly described. Author (TAB)

N69-27475# Technische Hogeschool, Delft (Netherlands)
THE PROPULSION OF AIRCRAFT WITH LAMINAR FLOW CONTROL
Ir. E. Torenbeek Nov. 1968 90 p refs
(VTH-150) Avail: CFSTI

A systematic approach is given for a cycle analysis of various practical suction and propulsion systems for gas-turbine powered subsonic aircraft with laminar flow control. Definitions of thrust, drag, and various system efficiencies are discussed, and the range parameter is evaluated as a criterion for cruise performance assessment. Generalized calculations and diagrams are presented for preliminary estimation of the range parameter for aircraft with arbitrary extent of laminarization. Conditions for the optimum value of system parameters are derived, resulting in maximum specific range. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-26261*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
ON THE RELATIONSHIP BETWEEN RECENT MEASUREMENTS OF COSMIC RAY ELECTRONS, NONTHERMAL RADIO EMISSION FROM THE GALAXY AND THE SOLAR MODULATION OF COSMIC RAYS
W. R. Webber Adelaide Adelaide Univ. Jan. 1968 72 p refs
(Grants NSG-281-62; AF-AFOSR-1183-67)
(NASA-CR-101090; ADP-43) Avail: CFSTI CSCL 04A

If the local interstellar electron spectrum which best reproduces the spectrum of local radio emissivity is compared with the electrons expected as secondaries from cosmic ray collisions in the galaxy, it is found that most electrons $\leq$ 300 MeV may originate via the secondary mechanism rather than be directly accelerated as are the higher energy electrons. Emission measures of $<0.5\text{cm}^{-6}\text{pc}$, $20\text{cm}^{-6}\text{pc}$ and $10^{3}\text{cm}^{-6}\text{pc}$ are found in the polar, anti-centre and galactic center directions respectively. These values are substantially below earlier estimates and would seem to rule out the existence of a large H_{II} region about the sun, for example. Finally we note that the interstellar intensity of cosmic ray nuclei above 30 MeV deduced using a residual modulation constant = 0.75 BV is inadequate by two orders of magnitude to produce the required heating of interstellar H_{II} clouds. Author

N69-26322*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
A MEASUREMENT OF THE SPECTRUM OF COSMIC RAY ELECTRONS BETWEEN 20 MeV AND 4 BeV IN 1968: FURTHER EVIDENCE FOR EXTENSIVE TIME VARIATIONS OF THIS COMPONENT
J. Rockstroh and W. R. Webber Feb. 1969 41 p refs
(Grant NGL-24-005-008)
(NASA-CR-101119; CR-126) Avail: CFSTI CSCL 04A

The intensity and spectrum of cosmic ray electrons from 20 MeV to 4 BeV were measured at a depth of 2.5 g/cm^2 in the summer of 1968, at a time when solar modulation effects had reduced the sea level neutron monitor rate by about 12% below its sunspot minimum value. The instrument used and its calibration were identical to that used in previous flights to study electrons at this location in 1965 and 1966. The total electron intensity at 2.5 g/cm^2 atmospheric depth at energies greater than 2 BeV in 1968 was essentially the same as that observed in 1966; however, at lower energies the intensity was greatly reduced in 1968. This reduction was a factor of 4 in the 200-400 MeV range. Atmospheric growth curves were used to determine the contribution of atmospheric secondary electrons. The deduced extraterrestrial electron intensity appears to be a factor approximately 7 lower in 1968 than in 1966 at energies just above 200 MeV. At higher energies the decrease becomes less. These results confirm earlier measurements of the solar modulation of electrons made in 1965–1966. Author

N69-26360 Trinity Coll., Dublin (Ireland).
THE SOLAR BALMER LINES
Ian Elliott (Ph.D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-17557

The height and temporal variations of the kinematic properties of the solar atmosphere are studied by means of the local Doppler shifts in high dispersion spectra of the Balmer lines. The spectra refer to quiet regions near the centre of the solar disk and the fluctuations of the absorption line profiles reflect the vertical velocities of the macroscopic inhomogeneities. The height variation of the velocity field is studied by means of pairs of simultaneous spectra of the Balmer lines: Hα Hβ, Hα Hγ, Hβ Hδ, Hα Hδ. The fluctuations of the line profiles from the mean positions for each line width are measured on an automatic measuring machine and converted to velocities. The random turbulent velocity ζ decreases steadily from line centre to wing of each line, apart from minor discrepancies caused by subsidiary lines. The variation of $\zeta(\Delta\lambda)$ for the Balmer lines follows the line absorption coefficient and we deduce that ζ increases steadily with height in the solar atmosphere. Dissert. Abstr.

N69-26438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF THE ENERGY SPECTRA OF COSMIC RAY HELIUM AND HEAVY NUCLEI
T. T. von Rosenvinge (Minn. Univ., Minneapolis), W. R. Webber (Minn. Univ., Minneapolis), and J. F. Ormes Minneapolis, Minn. Minn. Univ. Mar. 1969 37 p refs Prepared jointly by NASA, Goddard Space Flight Center and Minn. Univ., Minneapolis
(Grant NGL-24-005-008)
(NASA-TM-X-61681; CR-130) Avail: CFSTI CSCL 04A

Recent observations of the spectra of cosmic ray helium, M, LH and VH nuclei in the energy range from $\leq$ 200 MeV/nuc to $>$ 22 BeV/nuc are reported. The differential spectra of all of these groups of nuclei are found to have a maximum at 300–400 MeV/nuc at sunspot minimum. The average exponents on the integral rigidity spectra in the range 5 to 50 BV are 1.54 $\pm$ 0.03 for He nuclei, 1.50 $\pm$ 0.04 for M nuclei, 1.47 $\pm$ 0.06 for LH

nuclei and 1.40 ± 0.08 for VH nuclei. The spectra of these groups of nuclei are compared and it is found that the average He/M, He/LH and He/VH ratios are 16 ± 1, 70 ± 3 and 200 ± 15 respectively. These values are reasonably constant from the highest down to the lowest energies measured although some evidence for a dip is present in the 500–1000 MeV/nuc range for both the He/LH and He/VH ratios. Solar modulation effects on these ratios are discussed and it is concluded that the ratios measured at earth are representative of those existing in interstellar space only if energy loss processes in interplanetary space are unimportant.
Author

N69-26487*# Volt Information Sciences, Inc., Washington, D.C.
ON THE APPLICATION OF DIMENSIONALITY ANALYSIS TO QUESTIONS OF INTERPLANETARY GAS MOTION DURING SOLAR FLARES
V. P. Korobeynikov Greenbelt, Md. NASA. Goddard Space Flight Center 26 May 1969 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Ser. Gidromekhan. (Moscow), v. 185, no. 6, 1969 p 1254–1257
(Contract NAS5-12487)
(NASA-CR-101091; ST-IS-SP-HM-10839) Avail: CFSTI CSCL 03B

The motion processes outside the seat of a flare in hydrodynamic approximation are discussed. The relevant basic gas parameters are ascertained and, neglecting some of them, the π-theorem of dimensionality is used. Only a spherically-symmetrical model medium motion is considered. After elaborate discussions, formulas are derived and converted. The results are applied to the simplest case of gas motion dependence on coordinates and time. The influence of the magnetic field on interplanetary gas motion is mentioned.
Author

N69-26550# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
COHERENT SYNCHROTRON DECELERATION AND THE EMISSION OF TYPE 2 AND 3 SOLAR RADIO BURSTS
A. F. Kuckes and R. N. Sudan Apr. 1969 38 p refs
(Grant NSF GA-989)
(LPS-11) Avail: Issuing Activity

The coherent synchrotron deceleration of hundred keV electrons is proposed as the mechanism by which type 2 and 3 solar radio bursts are generated. This mechanism directly excites the transverse electromagnetic radiation by a linear mechanism at the relativistic electron cyclotron frequency and at the first harmonic thereof if the energy spread of the exciting component is sufficiently narrow. Higher cyclotron harmonics are excluded by the energy spread in the hundred keV exciting electron component. This mechanism appears to fit the observational data concerning these emissions somewhat better than the existing theory based on the nonlinear interaction of electrostatic plasma waves.
Author

N69-26560*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
GENERAL STUDY OF SOLAR PROMINENCES AND THEIR EVOLUTION CARRIED OUT WITH THE AID OF SPECTROHELIOGRAMS OBTAINED AT THE OBSERVATORY OF MEUDON, AND BY SYNOPTIC MAPS OF THE CHROMOSPHERE PUBLISHED BY THIS ESTABLISHMENT UNDER THE AUSPICES OF THE INTERNATIONAL ASTRONOMICAL UNION [PROTUBERANCES SOLAIRES ET DE LEUR EVOLUTION EFFECTUEE A L'AIDE DES SPECTROHELIOGRAMMES OBTENUS A L'OBSERVATOIRE DE MEUDON ET DES CARTES SYNOPTIQUES DE LA CHROMOSPHERE PUBLIEES PAR CET ETABLISSEMENT SOUS LES AUSPICES DE L'UNION ASTRONOMIQUE INTERNATIONALE]
L. D'Azambuja et al Washington NASA Apr. 1969 278 p refs Transl. into ENGLISH from Ann. Astrophys. (Paris), v. 6, fasc. 7, 1948 p 1–276
(Contract NASw-1692)
(NASA-TT-F-12179) Avail: CFSTI CSCL 03B

A generalized study of solar phenomena, prominences, and their evolution is presented. It was observed that there is not only general agreement between the fluctuation of sunspot and prominence activity, but also under certain circumstances, the appearance of the spots in a localized region of the sun was followed by a recrudescence of the prominences in the same region. The individual evolution of the prominences and the regions of activity which develop around the spots are studied. In a rather general fashion, it is shown that the latitude of formation of these phenomena precisely follows that of the spots in the course of the eleven-year period, and that in addition, there clearly exists, in certain cases, a very distinct relationship of position and time between the appearance of one spot and that of a filament. Their period of duration and median dimensions were precisely determined. Detailed statistics of the activity of the filaments and catalogs of the facular plages and recurrent filaments for the period 1919-1930 are included.
Author

N69-26645# Space Disturbances Lab., Boulder, Colo.
AN ANALYSIS OF SUDDEN IONOSPHERIC DISTURBANCES ASSOCIATED WITH THE PROTON FLARE OF 0026 UT, 7 JULY 1966
R. F. Donnelly Oct. 1968 68 p refs Sponsored in part by ESSA
(Grant NSF GP-3092; ARPA ORDER 932)
(AD-678999; SDL-3; ERL-86) Avail: SOD $0.65 CSCL 4/1

The X-ray and extreme ultraviolet radiation deduced from sudden ionospheric disturbances are discussed for the solar flare of 0026 ut, July 7, 1966. The sudden frequency deviation for the event has the largest duration of all SFD's observed at Boulder.
Author (TAB

N69-27126*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THREE FREQUENCY OBSERVATION OF THE 1967 CRAB NEBULA OCCULTATION BY THE SOLAR CORONA
Larry W. Brown (M.S. Thesis—Md. Univ., College Park) May 1969 41 p refs Submitted for publication
(NASA-TM-X-63547; X-615-69-211) Avail: CFSTI CSCL 03B

The results of an observation of the occultation of the Crab Nebula by the solar corona for June 1967 are reported. The occultation was observed at 139 MHz, 403 MHz, and 1705 MHz using the 85-foot antenna of the NASA Satellite Tracking Network at Rosman, North Carolina. An enhancement and reduction of flux was observed at 403 and 1705 MHz. The maximum enhancement was 16% ± 12% at 6.5 solar radii and 7% ± 11% at 5.2 solar radii for 403 MHz and 1705 MHz, respectively. The minimum flux occurred at 4.8 solar radii with a 30% ± 12% decrease at 403 MHz and 14% ± 11% at 1705 MHz. Measurements at 139 MHz proved too contaminated by solar radiation to yield useful results. The observations support previous reports of discrepancies in the multiple scattering mechanism and extend the wavelength range of the disagreement to 18 cm.
Author

N69-27156# Lockheed Missiles and Space Co., Palo Alto, Calif.
RESULTS OF MEASURING FAST CHARGED PARTICLES ON THE COSMOS 137
S. N. Vernov et al 1969 7 p refs Transl. into ENGLISH from Kosmich. Issled. v. 7, no. 2, 1969 p 273–278
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results obtained on the Cosmos 137, using a global Cerenkov counter to record fast charged particles, are discussed. The measured particle fluxes in the inner region of the inner radiation belt differ somewhat from the fluxes recorded by Explorer 11 in 1961. The difference in the fluxes before and after the high altitude thermonuclear experiments is apparently explained by energetic electrons of artificial origin which remained in the inner radiation belt up to the end of 1966. The position of the Cosmos 137 orbit permitted information to be obtained on the radiation belts in a significantly broader domain of space than in the Explorer 11 flight. It was established that the flux of charged particles with $E > 7$ Mev in the $L > 3.3$ domain is small as compared with the flux of cosmic rays. However, an outer belt of hard electrons was detected in the $L \approx 2.8$ domain. Also presented is the integrated cosmic ray spectrum for the beginning of 1967, computed by means of the latitude dependence of the intensity recorded during flight outside the domain of the radiation belts. Author

N69-27163# Lockheed Missiles and Space Co., Palo Alto, Calif.
SCIENTIFIC APPARATUS COMPLEX ON THE COSMOS 137 TO INVESTIGATE RADIATION IN NEAR-EARTH SPACE
I. A. Savenko et al 1969 10 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 9, no. 2, 1969 p 236–224
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The research problem and the demands imposed on an apparatus to study the radiation in near-earth space are formulated. A block-diagram of the apparatus complex mounted on the "Cosmos-137" is presented. A brief description is given of the detectors, and of the method of delivering the information by telemetry. Author

N69-27164# National Physical Lab., New Delhi (India). Radio Propagation Unit.
ION COMPOSITION–2. NOCTURNAL ION COMPOSITION IN THE HEIGHT RANGE OF 200–1000 KM FOR SOLAR MINIMUM CONDITION
V. P. Bhatnagar 1 May 1968 30 p refs
(RPU-S42; SR-42) Avail: CFSTI

The electron density at the F2 layer maximum and in the topside ionosphere at moderate and high latitudes maintains almost a constant value during winter nights under low solar activity conditions except around sunrise and sunset times. A nighttime ionic composition model for such steady state condition has been developed for minimum solar activity period ($F_{10.7} = 70$ units) and is based on the neutral atmospheric model and electron and ion temperatures. The calculated distribution of O^+ agrees with that observed in the bottomside F2 region, if the rate coefficients for the charge exchange between O^+ and N_2, and O^+ and O_2 have values of about $(0.8-1.0)\times 10^{-12}$ cm^3/s and $(0.8-1.0)\times 10^{-11}$ cm^3/s at F region temperatures. These values agree with the measured laboratory values within a factor of 2. A downward flux of the order of 10^8 electrons cm^{-2}/s is required to maintain the observed peak electron density of the F2 region. Author

N69-27439# Uppsala Univ. (Sweden). Institute of Physics.
GEOPHYSICAL ASPECTS OF COSMIC RAYS Final Report
Arne Eld Sandstrom Nov. 1968 67 p refs
(Contract AF 61(052)-868)
(AD-683774) Avail: CFSTI CSCL 4/1

The report comprises a study of the so-called 27-day recurrence tendency. The results of the latter are given in the form of histograms. The bulk of these, constituting the basic matter, are collected in an appendix. The study confirms the existence of a periodic variation of the cosmic ray intensity. Author (TAB)

N69-27612# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
A NUMERICAL STUDY OF PARTICLE ACCELERATION IN THE MAGNETOSPHERE
Tsutomu Tamao and Osamu Ashihara Jan. 1969 15 p refs
Its ISAS Vol. 34, No. 1
(ISAS-434-Vol-34-No-1) Avail: CFSTI

In order to obtain the quantitative result for wave-particle interaction within the complicated magnetospheric configuration, the Fermi acceleration of energetic electrons trapped within the dipole magnetic field due to the interaction with a large-amplitude hydromagnetic pulse is numerically analyzed, under the condition of the magnetic moment conservation. Associated with the geomagnetic sudden commencement, if this pulse propagates from the equator to high latitudes along the particular field line multiple head-on collisions of the particle with the moving pulse yield the net acceleration and secular lowering of the mirror point, until the mirror point is overtaken by the pulse. Assuming a model distribution of the plasma density and Poynting flux conservation of the pulse during its propagation, the motion of an interacting electron is determined in detail for various initial equatorial pitch angle. It is shown that the acceleration by this process is most effective for trapped particles near the equator. From results of the present numerical study, one cannot expect the appreciable particle precipitation associated with the geomagnetic ssc by only consideration of the Fermi process, and other more intense acceleration mechanism will be necessary in the real magnetosphere. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-26235*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATISTICS OF THE REGION OF LACERTA OB1
George Coyne, Jaylee Burley Mead, and Michele Kaufman Washington May 1969 21 p refs
(NASA-TN-D-5060) Avail: CFSTI CSCL 03A

Spectral classes and photographic magnitudes have been determined for 3621 stars in the region of the association Lacerta OB1. Astrophotometer measures of images on glass reproductions of the Palomar Sky Survey plates have been used for the photometry, and spectral classes have been determined by using color equivalents according to the Tikhoff method. The star counts indicate that there is an excess of early A stars on the main sequence in the concentrated region of the association as compared with the dispersed region. Also, the total area of our survey shows a deficiency of stars later than F5 as compared with counts in nearby Selected Areas. It is recommended that membership determinations be made for the A stars that constitute the clustering in the concentrated region of the association. Author

N69-26239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UNACCELERATED GEOCENTRIC VELOCITIES AND INFLUX RATES OF SPORADIC PHOTOGRAPHIC METEORS
C. D. Miller Washington NASA May 1969 61 p refs
(NASA-TN-D-5245) Avail: CFSTI CSCL 03B

A weighting factor to correct photographic bias due to mass and velocity was applied to Smithsonian data for over 2000

sporadic meteors. The factor was supported by confirmation of predicted agreement between a velocity histogram for meteors of all masses obtained with its use and a raw distribution for large masses. An equation was found for geocentric velocity distribution unaccelerated by earth gravity. Exponent of mass of 1.34 was obtained in equation for cumulative mass distribution using mass scale of McCrosky and Posen. An average velocity of 13.8 km/sec was obtained, virtually independent of mass. Author

N69-26252*# National Aeronautics and Space Administration. Goddard Spaceflight Center, Greenbelt, Md.

AN ACCURACY AND SPEED COMPARISON OF THE VINTI AND BROUWER ORBIT PREDICTION METHODS

M. L. Bonavito, Stan Watson, and Harvey Walden Washington May 1969 13 p refs

(NASA-TN-D-5203) Avail: CFSTI CSCL 22C

The Viniti orbit prediction method, developed as part of the tracking and prediction program for artificial earth satellites, was compared with the Brouwer orbit prediction method using versions of both methods which consider the first four zonal harmonics of the earth's gravitational field. Several sets of inertial coordinates and velocities for both real and hypothetical satellites were used to produce 100 revolutions of each orbit. Prediction accuracy was investigated by comparing the in-track position error accumulated by each of the two methods every 10 revolutions. In every case it was found that the Vinti method produced considerably less in-track error, while operating at a computational speed comparable to that of the Brouwer method. Furthermore, it was observed that when one attempts to augment the Brouwer method so that its accuracy will be of the same order as that of the Vinti theory, the computational speeds of the two methods are no longer comparable; rather, the Vinti program is estimated to be faster by at least a factor of eight. Author

N69-26283# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

SPECTROMETER FOR COSMIC AND SOLAR PROTON: EXPERIMENT S-72 ABOARD THE SATELLITE ESRO 2 [SPECTROMETRE POUR PROTONS COSMIQUES ET SOLAIRES: EXPERIENCE S-72 EMBARQUEE A BORD DU SATELLITE ESRO 2]

Yves Amram, Guy Detourne, Christian Hugot, Pierre Malaval, Jacques Andrejol et al Dec. 1968 86 p refs In FRENCH; ENGLISH summary

(CEA-R-3700) Avail: CFSTI

An experiment designed for the spectrometry of charged particles, and intended for the European satellite ESRO 2, the launch of which is planned for May 1968 is described. The polar orbit of this satellite permits measurement, depending on the geomagnetic latitude, of either the energy of solar protons, or the spectrum of the protons of the internal Van Allen belt, or even the abundance of galactic nuclei with charge less than 6. The equipment includes a sensor with a telescope of solid state detectors of large area (lithium drifted silicon) and the preamplifiers. The electronic unit includes the amplifiers, the pulse height discriminators and the coincidence circuits, the analog-to-digital converter which encodes the energy loss of an incident particle in one of the detectors, the scaler for counting the flux of the particles, and the interface to the telemetry system of the satellite. The equipment weighs 1350 grams, drains 350 mW and is designed for normal operation from −20°C to +50°C. The design principles are discussed and the circuits described. The modifications carried out on the flight model F2 after the failure of the launch of the model F1 in May 1967 are also reported. Author (ESRO)

N69-26287# Institut Royal Météorologique de Belgique, Brussels.

IONOSPHERIC OBSERVATIONS [OBSERVATIONS IONOSPHERIQUES] Monthly Bulletin, Dec. 1968

Dec. 1968 25 p In FRENCH and DUTCH

Avail: CFSTI

Ionospheric data derived from observations made by the Royal Institute for Meteorology, Uccle (Belgium) in December 1968 are given. ESRO

N69-26382 Maryland Univ., College Park.

OPTICAL AND RADIO EVIDENCE OF LARGE-SCALE PECULIAR MOTIONS IN THE CAS-PER ARM

James Joseph Rickard (Ph.D. Thesis) 1968 79 p

Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No 68-16684

Recent optical data of young open clusters, H II regions, O-associations, interstellar extinction, and interstellar absorption lines together with new high resolution 21-cm line hydrogen maps of the Cas-Per spiral arm indicate that the interstellar medium in a large section of the arm is moving with peculiar radial velocities of the order of −20 to − 30 km/sec. A distance estimate based upon the interstellar absorption lines, interstellar extinction, and H II regions indicates that the gas, dust, and ionized elements are situated 1.5 to 2.5 kpc from the sun. A new determination of Oort's constant A shows that the extremely young clusters with H II regions form a peculiarly moving kinematic group (group P), distinct from the normally moving O-associations and other young clusters (group N). The age of the group P objects is about 6×10^6 years, while that of the group N objects is estimated to be 10 to 30×10^6 years. The mass and gas-to-dust ratio of the Cas-Per arm are also calculated. Dissert. Abstr.

N69-26403# Library of Congress, Washington, D.C. Aerospace Technology Div.

A MONTHLY REVIEW OF SELECTED FOREIGN SCIENTIFIC AND TECHNICAL LITERATURE, VOLUME 6, NUMBER 4 Foreign Science Bulletin

Apr. 1969 243 p refs

Avail: Issuing Activity

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N69-26410*# New Mexico State Univ., Las Cruces. The Observatory.

LATITUDE AND LONGITUDE MEASUREMENTS OF JOVIAN FEATURES IN 1967–68

E. J. Reese and H. G. Solberg Apr. 1969 29 p refs

(Grants NGL-32-003-001; NGR-32-003-027)

(NASA-CR-101143; TN-701-69-28) Avail: CFSTI CSCL 03A

Photographic observations of Jupiter during the apparition of 1967–1968 are discussed. Several interesting oscillations and accelerations in the motions of atmospheric features are described in detail. Photographic measurements of the latitudes of the Jovian belts and a number of selected features are summarized. Author

N69-26456*# Ohio State Univ., Research Foundation, Columbus. Dept. of Geodetic Science.

THE USE OF SHORT ARC ORBITAL CONSTRAINTS IN THE ADJUSTMENT OF GEODETIC SATELLITE DATA

Charles Reed Schwarz Jan. 1969 118 p refs

(Grant NGR-36-008-093; OSURF Proj. 2514)

(NASA-CR-101089; Rept-118) Avail: CFSTI CSCL 22A

In this report many different aspects of the orbital constraint adjustment are discussed, comparing it in many ways with the corresponding geometric mode adjustment. It is shown that for any given set of data, the orbital constraint adjustment will produce a solution that is as good as or better than the corresponding geometric mode adjustment. A description of the flow of a particular orbital constraint adjustment computer program is presented. A series of experiments involving photographic plates is described. The path of the satellite appears as a trail of small dot-like images on these plates, and the possibility of imposing an orbital constraint on these trails is discussed. Results are presented of the adjustment of these images in the short arc orbital mode, and the results of several different configurations of geometric mode adjustments are given for the sake of comparison. These results indicate that for short enough arcs the modeling error may be suppressed and the orbital mode adjustment yields an unbiased solution which is almost the same as that obtained by the geometric method. Author

N69-26457*# Volt Information Sciences, Inc., Washington, D.C.

RENDEZVOUS WITH VENUS

N. Lazreva Greenbelt, Md. NASA. Goddard Space Flight Center 23 May 1969 5 p Transl. into ENGLISH from Nedelya (Moscow), 18 May 1969 p 5

(Contract NAS5-12487)

(NASA-CR-101101; ST-PR-OA-PS-10838) Avail: CFSTI CSCL 03A

It is well known that the distance between the Earth and Venus is inconstant. The "morning" and the "evening" star either goes away from us by about 360 million kilometers, or returns again, approaching the surface of our planet by almost 50 million kilometers. At the present time Venus drifts away from the Earth and will return only in November of the next year. During the time of recurrent "rendez-vous" having taken place from February to April, a series of interesting observations were conducted at the Crimean Astrophysical Observatory AN SSSR; unique ultraviolet films of the clouds of Venus atmosphere were obtained, and the moment of its passing by the Sun was imprinted. Author

N69-26488*# Volt Information Sciences, Inc., Washington, D.C.

RADIORAY INVESTIGATIONS CONTRIBUTE TO THE TREASURE OF HUMAN KNOWLEDGE

V. Troitskiy Greenbelt, Md. NASA. Goddard Space Flight Center 28 May 1969 6 p Transl. into ENGLISH from Pravda (Moscow), no. 139, 19 May 1969

(Contract NAS5-12487)

(NASA-CR-101113; ST-PR-LPS-10840) Avail: CFSTI CSCL 03A

The respective roles of ground, optical, and radar astronomy observations of nearby planets are examined. The discussion centers mainly on the moon and planet Mars with the view of comparing the physical conditions of both, while evaluating the extent to which the methods applied to the study of the former would apply to the latter. The knowledge acquired to date on physical conditions of Mars is considered in detail. While giving full credit to ground investigations as the basis of further studies, it is stressed that, so far, optical and radar investigations do not take advantage of their full potentialities; for example, submicrowave and longwave infrared bands are far from being mastered. The complete success of planet study can only be assured through complex, coordinated research by all methods available to science. Author

N69-26583# Nederlandse Commissie voor Geofysica en Ruimte-Onderzoek.

DESCRIPTION OF FIRST CONCEPT OF THE ASTRONOMICAL NETHERLANDS SATELLITE

15 Jan. 1969 77 p refs Prepared jointly with Industrieel Consortium Astronomische Ned. Satelliet

(C-69-1) Avail: CFSTI

The possibility of supplementing Dutch participation in international space programs with a national program is explored, and plans are being developed for a satellite project based on experiments submitted to the Netherlands Committee on Geophysics and Space Research. The proposed experiments for observing stars in the UV and soft X-ray region are: (1) a UV telescope (diameter main mirror 20 cm) with spectrograph and photomultipliers to observe the light of stars in four UV bandwidths between 1500 and 3300 Å; and (2) a detector system for stellar X-rays consisting of a detector with a deep parabolic reflector for wavelengths between 44 and 60 Å (maximum diameter parabolic reflector 20 cm), and another detector with a sieve plate collimator for wavelengths between 3 and 6 Å, 6 and 12 Å, and 27 and 35 Å. The Scout vehicle was selected for launching the satellite due to its economy and reliability. A preliminary program plan is presented as a basis for discussing the possibility of NASA entering into a bilateral arrangement with the Netherlands and providing launch vehicles and launching facilities. J.A.M.

N69-26602# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOVIET SPACE RESEARCH IN 1968

H. Schmidt 4 Nov. 1968 27 p Transl. into ENGLISH from Flieger-Jahrb. (E. Berlin), 1968 p 9–17

(AD-683957; FTD-HT-23-831-68) Avail: CFSTI CSCL 22/1

The Soviet space efforts during the year 1968 are reviewed and discussed. The construction, design details, and equipment aboard the Cosmos satellites, the Proton series, the Molniya satellites, and the various Luna moon satellites are given and described, and some photographs are included. The various design tasks of these satellites are outlined and some of the results that were obtained are given. TAB

N69-26638# Air Force Missile Development Center, Holloman AFB, N.Mex.

A STUDY OF SIX-DEGREE-OF-FREEDOM REENTRY DYNAMICS IN TERMS OF COUPLED HARMONIC OSCILLATOR THEORY USING QUASI-STATIC SOLUTIONS OF THE EQUATIONS OF MOTION

Norman E. Dupee, II Dec. 1968 46 p refs

(AD-683766; MDC-TR-68-86) Avail: CFSTI CSCL 16/2

The non-linear equations of motion of an axi-asymmetric ballistic reentry vehicle are simplified using analog computer results and solved analytically under the assumption that the atmospheric density is locally a constant (quasi-static assumption). The solutions are analyzed using the framework of coupled harmonic oscillator theory with the assumption that the rolling moment of inertia is negligible compared to the transverse moments of inertia. The motion of the reentry vehicle is shown to be composed of a gyroscopic (or mechanical) frequency and an aerodynamic frequency, and the interaction of these frequencies is discussed for damped and undamped hypothetical reentry trajectories. The solutions are restricted to altitudes where aerodynamic heating effects are negligible. Author (TAB)

N69-26689 California Univ., Los Angeles.

MIDCOURSE CORRECTION ANALYSIS FOR LUNAR IMPACT TRAJECTORIES

Wecheslav Hrushow (Ph.D. Thesis) 1968 306 p

Avail: Univ. Microfilms: HC $13.95/Microfilm $3.95 Order No. 68-16541

Only the magnitude of the impact miss is considered for correction. The method utilizes the impact parameter as the measure of the target miss. For correction of trajectories intended to impact a material point in space, or for correction of lunar fly-by trajectories, this method performs flawlessly. It also performs reasonably well when applied on standard trajectories which are defined as those having vertical impact on spherical lunar surface. Two kinds of deficiencies are determined: the possible incorrect magnitude of the computed midcourse correction velocity, and the nonuniqueness in relation between the target miss and the injection errors or midcourse correction velocity. A partial improvement of the method is proposed. A question of variation of the required midcourse correction velocity for a number of impact trajectories is analyzed. A method of normalization of the corrective velocity is presented. The functional dependence of the direction of the optimal midcourse correction velocity on certain motion parameters is developed. Dissert. Abstr.

N69-26682*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ELECTRON CAPTURE IN HIGHLY EVOLVED STARS

Daiichiro Sugimoto Apr. 1969 31 p refs Submitted for publication

(NASA-TM-X-63544; X-641-69-150) Avail: CFSTI CSCL 03B

When a star has evolved to a very high density (about 1×10^9 g cm^{-3}), continuum electron capture by iron nuclei begins to play a role. Effects of electron capture upon gravitationally contracting iron stars of 1.4 and 2 solar masses have been investigated. As the electron capture process is rather slow compared with the dynamical time scale for the density below 10^{11} g cm^{-3}, it can be treated as an endothermic nuclear reaction. In spite of the absorption of energy by electron capture, the central temperature of the star is found to increase as the contraction of the star proceeds. For this phenomenon, the accompanying increase in the mean molecular weight is essential. Thus, a significant part of the star is found to enter into a region of temperature high enough for the photo-disintegration of iron to occur, before the star collapses by electron capture itself; the photo-disintegration commences at the center of a star of 2 $M_\odot$, but in the outlying shells of a star of 1.4 $M_\odot$. Author

N69-26683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ELECTRICAL CONDUCTIVITY AND INTERNAL TEMPERATURE OF THE MOON

Norman F. Ness May 1969 15 p refs Presented at 12th COSPAR conf. as paper k11, Prague, 20 May 1969 Submitted for publication

(NASA-TM-X-63545; X-616-69-191) Avail: CFSTI CSCL 03B

Detailed measurements of the interplanetary magnetic field in the immediate vicinity of the moon have been performed since July 1967 by Lunar Explorer 35. The magnetic field is found to be only slightly distorted with no evidence for a bow shock wave. During the interval February to July 1968, periselene passed through the solar wind umbral region. A study of the propagation of discontinuities in the interplanetary magnetic field through the lunar body has been completed. The induction of electrical currents in the lunar interior indicates an effective time constant for eddy current decay of less than 20 seconds. This means an electrical conductivity of less than 10^{-4} mhos/meter in the lunar interior. The electrical conductivity of silicate rocks depends mainly upon temperature. Thus limitations on possible thermal models of the moon, consistent with the electrical conductivity measurements, can be obtained. These results are compared with various models of the thermal history to obtain a class of allowed lunar interiors. The conclusion is that the moon must be a relatively young body (1×10^9 years old) if it possesses a homogeneous heat source composition similar to chondritic meteorites. If differentiation of radiogenic heat sources near to the surface has taken place, the moon can be old (4×10^9 years). Author

N69-26703*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

COWELL TYPE NUMERICAL INTEGRATION AS APPLIED TO SATELLITE ORBIT COMPUTATION

Jesse L. Maury, Jr. and Gail P. Segal Apr. 1969 63 p refs Submitted for publication

(NASA-TM-X-63542; X-553-69-46) Avail: CFSTI CSCL 22C

The general philosophy of numerical integration is presented along with a description of the often used multistep numerical integration algorithms pertinent to orbit determination, and the derivation of the formulas and their various forms used in these multistep algorithms. The coefficients for different forms of these formulas are presented in rational form up to order fifteen. Author

N69-26803# Rice Univ., Houston, Tex. Dept. of Space Science.

SEARCH FOR GAMMA RADIATION FROM CENTAURUS A

R. C. Haymes, D. V. Ellis, G. J. Fishman, S. W. Glenn, and J. D. Kurfess Nov. 1968 12 p refs Submitted for publication

(Contract F44620-67-C-0062)

(AD-683358) Avail: CFSTI CSCL 03/2

The letter reports a search for radiation between 34 and 567 keV from a region in Centaurus that includes the radio galaxy Centaurus A. No radiation from Centaurus A at any energy within this interval was detected and upper limits to the flux have been established. Author (TAB)

N69-26818 Cornell Univ., Ithaca, N.Y.

A STUDY OF THE AVERAGE AND ANOMALOUS RADAR SCATTERING FROM THE SURFACE OF VENUS AT 70 cm WAVELENGTH

Raymond Francis Jurgens (Ph.D. Thesis) 1968 241 p

Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 68-15725

The surface properties of Venus that can be derived from the 70 cm wavelength radar observations made during 1964 inferior conjunction is presented here. In this study the convolutions involving the planetary scattering models and the radar ambiguity

function were carried out before fitting the models to the observations. Some results of the study show that the theoretical scattering models of Muhleman and Hagfors are able to fit the power vs delay observations within the accuracy of the data when pulse widths of one and two milliseconds are used in the measurements. Theoretical delay-Doppler spectra calculated from these models are in good agreement with the observations indicating that a simple incoherent scattering model is an adequate description of the target for the resolution that is presently possible at this wavelength. Dissert. Abstr.

N69-26856 Texas Univ., Austin.
CANONICAL TRANSFORMATION THEORY AND THE OPTIMAL LOW-THRUST PROBLEM
William Francis Powers (Ph.D. Thesis) 1968 186 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-16126

The methods of canonical transformation theory are introduced into the analysis of optimal trajectory problems. Since most optimal trajectory problems can be transformed into Hamiltonian systems which are isomorphic to the Hamiltonian systems of classical mechanics, canonical transformation theory is applicable immediately. The homogeneous and Hamilton-Jacobi canonical transformations are shown to be the most useful canonical transformations. The homogeneous transformation may be used to define Lagrange multiplier transformations, and to define new coordinate systems which simplify the relationship between the control variables and the Lagrange multipliers. The Hamilton-Jacobi transformation is applied to a number of problems. Two solutions of the coast-arc problem are obtained by canonical transformation procedures. Dissert. Abstr.

N69-26882# Office National d Etudes et de Recherches Aerospatiales, Paris (France).
ANALYTICAL OPTIMIZATION OF THE POSITIONING AND STATION KEEPING OF A GEOSTATIONARY SATELLITE [OPTIMISATION ANALYTIQUE DE LA MISE EN PLACE FINALE ET DU MAINTIEN EN POSITION D'UN SATELLITE GEOSTATIONNAIRE]
Nguyen Van Nhan 1969 72 p refs In FRENCH; ENGLISH summary
(ONERA-NT-140) Avail: CFSTI

The optimal positioning, after injection, and the optimal deterministic stationkeeping of a geostationary satellite are treated analytically. The longitude rendezvous (i.e. suppression of the mean longitude discrepancy and of the periodic discrepancy between the mobile and the immobility point considered as a target) is studied in detail by means of two different optimization methods which are compared: a purely analytical one, based on Pontryagin's Maximum Principle; an analytical and geometrical one, based on Contensou's theory of the Maneuverability Domain. The variations of the eccentricity of the satellite orbit that are induced by the longitude rendezvous maneuvers are also examined. The problem of stationkeeping, in the equatorial plane and out of the equatorial plane, is finally considered after a study of the effects of the different natural perturbations on the motion of the geostationary satellite. Author

N69-27022 Royal Greenwich Observatory, Herstmonceaux (England).
RADIAL VELOCITY OBSERVATIONS OF STANDARD STARS WITH THE 30 INCH COUDE SPECTROGRAPH
G. A. Harding, D. R. Palmer, and J. D. Pope 1968 15 p refs Prepared jointly with Roy. Obs., Cape Town, S. Africa *Its* Bull. No. 145
Copyright. Avail: HMSO 2s 6d

The new coudé spectrograph attached to the Thompson 30-inch reflector is described. A program of radial velocity observations of standard velocity stars designed to test the performance of the instrument shows it to be very stable. A measure of a single plate of a star with spectral type between F3 and M5 should provide a radial velocity with a real standard error of 1.0 km/s. Author

N69-27049# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
A NEW REDUCTION OF THE COLOURS OF T TAURI STARS WITH A DISCUSSION OF THEIR STRUCTURE AND EVOLUTIONARY BEHAVIOUR
S. Plagemann Paris ESRO Oct. 1967 37 p refs
(ESRO-SN-13) Avail: CFSTI

The chief problems presented by the structure and evolution of T Tauri stars are their position in the H-R diagram, their spectral characteristics and their luminosity curves. Iben's theoretical H-R diagram of pre-main sequence evolution of dwarf stars is discussed in detail and a suitable conversion is made of T_{eff} values to B-V values. As regards absorption and emission spectra, a critical study of the blue and ultraviolet continuous emission showed that in fact two types of UV emission exist: the first has its source in Balmer region emission, the second is connected with red-displaced components on the emission lines. Colour correction turns out to be a serious problem when T Tauri stars have to be placed on the H-R diagram. Various solutions are discussed, Smak's and Avenl's among others, and a new method is proposed which is based on the comparison of red excess (V-R) to infrared excess (V-IR). In the final section, a new correlation is suggested between the type of emission spectra and the shape of the light curve. This correlation is based on a new method of analysing the light curves of variable stars by making use of autocorrelation techniques and treating the light intensity as a combination of periodic signals and random noise. The author hopes that his method will lend itself to further improvements, in particular the use of filters. Author (ESRO)

N69-27169*# Israel Program for Scientific Translations, LTD., Jerusalem.
RR LYRAE STARS
V. P. Tsesevich 1969 365 p refs Transl. into ENGLISH of the book "Zvezdy Tipa RR Liry" Kiev, Izd. Naukova Dumka, 1966 Published for NASA and NSF *Its* Cat. No. 5443
(NASA-TT-F-562; TT-69-55025) Copyright. Avail: CFSTI CSCL 03A

Extensive observations on the individual properties of RR Lyrae stars are discussed, emphasizing problems of the stability and regularity of the oscillations. Topics covered include: stable and nonstable oscillations, regular and irregular variation of periods, and extreme and strange stars. A bibliography and an index to the stars discussed are included. E.C.

N69-27178*# Geological Survey, Washington, D.C.
PRELIMINARY LUNAR EXPLORATION PLAN OF THE MARIUS HILLS REGION OF THE MOON
T. N. V. Karlstrom, J. F. MacCauley Feb. 1968 45 p refs *Its* Astrogeology 5
(NASA Order-W-12388)
(NASA-CR-101225) Avail: CFSTI CSCL 22A

A preliminary lunar exploration plan (LEP) is presented for the Marius Hills region of the Moon. The Marius Hills region is one of the six sites considered by the GLEP site selection group as a candidate for manned exploration using mobility systems allowing a radius of operation of at least 5 km. The three day mission considered for the Marius Hills region is based on the use of one lunar roving vehicle and two lunar flying units and allows for four extravehicular activities of 3 hours each. Effective planning

for geologic field investigations on a lunar mission requires detailed consideration of (1) the best available information on the geology of the site to be explored and on relevant regional geology, and (2) operational and performance characteristics of launch vehicles, mobility systems, instrument systems, and communication systems. Author

N69-27323# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODEL OF THE ATMOSPHERE AND SURFACE OF MARS FROM THE HYPOTHESIS ON PURELY SCATTERING ATMOSPHERES
V. V. Sharonov 2 Jul. 1968 11 p refs Transl. into ENGLISH from the publ. "Voprosy Astrofiziki" Kiev, Izd. Naukova Dumka, 1965 p 72–78
(AD-683096; FTD-HT-23-403-68) Avail: CFSTI CSCL 13/2

Attempts to explain the visible phenomena on Mars and also the general properties of this planet (particularly, the unique coloration of Mars) have been made recently by several authors. The author discusses some of their reasoning. He gives preference to the diffusive theory, rather than the absorbent theory, for the atmosphere of Mars. TAB

N69-27325# Maryland Univ., College Park. Dept. of Chemistry.
ON THE PRODUCTION OF NUCLIDES WITH A > 250 STELLAR NUCLEOSYNTHESIS
V. E. Viola, Jr. 27 Nov. 1968 30 p refs
(Contract AT(40-1)-3783)
(MNC-3783-1) Avail: CFSTI

An attempt is made to explore the extent to which nuclides with A > 250 may have been formed during stellar nucleosynthesis and the subsequent fate of such species during cosmological time. Two recent results concerning the nuclear behavior of the heaviest elements bear directly on these questions; i.e., (1) the measured yields of multiple neutron-capture products in thermonuclear explosions, and (2) the apparent fission instability of N = 158 isotones. In addition, these considerations are relevant to the questions of U–Th abundance in nature and the possible role of spontaneous fission decay in Type I supernovae, which are also discussed. As a basis for discussion, the multiple neutron capture model (r-process) of Seeger, Fowler, and Clayton was chosen. However, the results can in general be applied to any nucleosynthesis process which occurs on a time scale longer than milliseconds. NSA

N69-27412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY MODEL COMPARISON USING GEOS 1 LONG-ARC ORBITAL SOLUTIONS
Francis J. Lerch, James G. Marsh, and Brian O'Neill (Wolf Res. and Develop. Corp., Bladensburg, Md.) Washington Jun. 1969 47 p refs
(NASA-TN-D-5035) Avail: CFSTI CSCL 22C

Satellite tracking data have been analyzed using three different sets of coefficients in the mathematical model that describes the earth's gravitational field. The results were intended to be used not as a definitive evaluation of the different coefficients but as an assessment of the effects that different published sets of coefficients, station coordinates, and earth parameters have on orbital geodetic results. Orbital solutions were estimated from optical tracking data from the GEOS I satellite, taken by five major geodetic optical tracking networks. The residual differences between the observed and computed ranges were analyzed for zero-set range bias errors, timing errors, and random errors. These comparisons serve to reinforce what was intuitively obvious–that for long-arc geodetic work, the most complete set of gravity coefficients, together with consistent station coordinates, should be used. Author

N69-27430*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY 37-55. VOLUME 3: SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT, 1 DECEMBER 1968–31 JANUARY 1969
28 Feb. 1969 273 p refs
(Contract NAS7-100)
(NASA-CR-101128; JPL-SPS-37-55-Vol-3) Copyright. Avail: CFSTI CSCL 03A

Technical information, resulting from current engineering and scientific work, is reviewed. The research areas pertain to systems analysis, space sciences, communications systems, communications elements, spacecraft telemetry and command, spacecraft radio, spacecraft telecommunications systems, flight computers and sequencers, spacecraft power, guidance and control analysis and integration, spacecraft control, materials, applied mechanics, electronics parts engineering, aerodynamic facilities, solid propellant engineering, polymers, liquid propulsion, and advanced concepts. Author

N69-27440*# Stanford Univ., Calif.
SIMULTANEOUS OPTICAL AND RADIO OBSERVATIONS OF NP 0532
E. K. Conklin and H. T. Howard [1968] 9 p refs
(Contract NSR-05-003-100)
(NASA-CR-101227) Avail: CFSTI

Simultaneous optical and radio observations of the Crab Nebula pulsar, NP 0532, were obtained at Lick Observatory and Stanford University respectively, on March 13 and 15. While exact mechanisms responsible for the radio and optical emissions are still not clear, the detection of a time interval (if any) between the optical and radio pulses would be an important test of the various emission theories. The data show, after correction for interstellar dispersion, that the optical and radio pulses are emitted simultaneously with a phase uncertainty of ± 6 milliseconds which results almost entirely from the uncertainty in the value of the interstellar dispersion. The measured phase delay before correction is accurate to approximately 250 microseconds. Author

N69-27474# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
MOTION OF EARTH SATELLITES IN THE ATMOSPHERE WITH NONSPHERICAL DISTRIBUTION OF DENSITY DEPENDENT ON THE ALTITUDE [DVIZHENIE SPUTNIKOV ZEMLI V ATMOSFERE S NESFERICHESKIM RASPREDELENIEM PLOTNOSTI ZAVISYASHCHIM OT VYSOTY]
A. M. Fominov Nov. 1960 24 p refs Transl. into ENGLISH from Byul. Inst. Teor. Astron. (USSR), v. 10, no. 9 (122), 1966 p 600–610
(AD-683909; ACIC-TC-1470) Avail: CFSTI CSCL 22/2

The paper gives the formulae for the change of the orbital elements after one revolution of a satellite around the earth, provided the scale-height, and the latitude and diurnal coefficients depend on the geocentric distance. The errors that arise in the air density and in the diurnal parameters are estimated when these parameters and the scale-height are assumed to be constant. Author (TAB)

N69-27540# Congress, House. Committee on Science and Astronautics.
NASA AUTHORIZATION, 1970, PART 2, NO. 3
Washington GPO 1969 1227 p Hearings before Subcomm. on Manned Space Flight, 91st Congr., 1st Sess., Feb. 28, Mar. 6, 7, 8, 11, 12, 14 and 25, 1969
Avail: SOD $5.00

Accomplishments and program plans of the manned space flight program are reviewed. NASA requests for appropriations are estimated. Emphasis for future plans is placed on extended lunar exploration, space stations, and accompanying logistics. B.P.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-26201*# Goodyear Aerospace Corp., Akron, Ohio.
THE MODIFICATION AND USE OF A GROUND-BASED PHOTOMETER FOR EVALUATION OF SATELLITE MATERIALS
D. C. Romick, R. H. Emmons, R. J. Preski, and E. D. Kalasky 7 Jun. 1968 114 p refs
(Contract NAS1-6436)
(NASA-CR-66772; GER-13830) Avail: CFSTI CSCL 22B

Multicolor photometric and polarimetric observations indicate that the aluminized Mylar satellites, Echo 1 and PAGEOS 1, degrade very slowly, if at all, in the space environment. Echo I, which has been in orbit for almost eight years, has shown little change in its optical properties until the last observation period. The slight diminishing in the reflectance and specularity obtained photometrically then may be correlated with the satellite's interaction with the earth's upper atmosphere. The PAGEOS 1 satellite has shown negligible change in its optical properties; the slight variations that have been indicated have not followed any consistent trend and are within the limits which might reasonably be expected from variations in atmospheric conditions and other factors involved. Multicolor photometric and polarimetric observations of the Echo 2 satellite performed thus far have shown considerable variation from laboratory measured values for Alodine in air; however the meaning of this is not yet clear. V-band observations performed on the Explorer 19 satellite indicate that the present optical and physical properties are close to prelaunch design values. The information contained in the Explorer 19 observational data on spin rate and other characteristics strongly attest to the potential capability of this method of measurement of orbiting satellite characteristics. Author

N69-26323*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ATTITUDE STABILIZATION OF SPACECRAFT WITH GEOMAGNETIC RATE DAMPING
V. L. Pisacane Apr. 1969 47 p refs
(Contract NOw-62-0604-c)
(TG-1058) Avail: CFSTI CSCL 22B

Two damping systems are studied which can be used as part of the attitude control systems of geomagnetically, gravitationally, or spin-stabilized spacecraft. The devices are active and passive geomagnetic rate dampers that use the relative motion between the spacecraft and an ambient magnetic field to produce the required torques. The expressions for the torques generated by each device are derived. To investigate the usefulness of the dampers, an analytical study is made of the attitude performance of gravitationally stabilized spacecraft. To verify the assumptions that were made to make the dynamical problem analytically tractable, a digital simulation study is presented. Good agreement is obtained. The characteristics and applicability of each type of damper are also discussed. Author

N69-26405# Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET ORBITAL ASSEMBLY TECHNOLOGY
Alexander Dolgich *In its* A Monthly Rev. of Selected Foreign Sci. and Tech. Lit., Vol. 5, No. 4 Apr. 1969 p 178–191 refs (See N69-26403 14-30)
Avail: Issuing Activity

An interpretive review is presented of orbital spacecraft assembly technology, based on the Soviet open literature. Special attention is devoted to the possible configuration of future Soviet manned structures assembled in space, including the lunar satellite station. The main building component of future laboratories and vehicles for interplanetary travel is presumed to be the Soyuz-type spacecraft, equipped with two two-chamber liquid-propellant engines. Author

N69-26406# Library of Congress, Washington, D.C. Aerospace Technology Div.
KOSMOS SATELLITE LAUNCHINGS DURING 1968
Daniel W. Michaels *In its* A Monthly Rev. of Selected Foreign Sci. and Tech. Lit., Vol. 5, No. 4 Apr. 1969 p 192–198 refs (See N69-26403 14-30)
Avail: Issuing Activity

Cosmos satellite launchings of 1968 are analyzed by observers of the Junge Welt Satellite Observation Station and others on the basis of orbital elements and probable mission. Several new types of launchings are identified. Author

N69-26458*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT-TEST RESULTS FROM SUPERSONIC DEPLOYMENT OF AN 18-FOOT-DIAMETER (5.49 METER) TOWED BALLUTE DECELERATOR
John J. Mayhue and Clinton V. Eckstrom Washington May 1969 26 p refs Film Supplement Number L-1045 to this report is available on loan from NASA, Langley Research Center, Langley Station, Va.
(NASA-TM-X-1773) Avail: CFSTI CSCL 22B

A ram-air-inflated, towed ballute decelerator having a maximum frontal diameter of 18 feet (5.49 meters) was deployed during free flight at a Mach number of 3.15 and a dynamic pressure of 38.5 lb/ft^2 (1843.4 N/m^2). Deployment and extraction of the test ballute were normal but inflation stopped about 1 second after mortar firing and produced an average plateau drag force of 1500 pounds (6.7 kN) for about 1 second. Approximately 30 percent of expected total frontal area was obtained. Examination of a motion-picture film showed no unusual events during initial filling of the ballute; however, shortly after ballute growth stopped, failure of the fabric at one inlet leading edge was observed. A large aft-end rip also became evident after decay of the plateau drag forces later in the flight. It is postulated that incomplete filling of the test ballute may have been caused by prolonged whipping action of the envelope fabric which prevented sufficient inlet exposure, eventually led to inlet failure, and may have contributed to an aft-end rip during the initial inflation process. Author

N69-26463*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SPACE STATIONS: GATEWAY TO OUR FUTURE IN SPACE
Robert R. Gilruth 1968 44 p Presented at 4th Intern. Symp. on Bioastronautics and the Exploration of Space, San Antonio, 25 Jun. 1968
(NASA-TM-X-61680) Avail: CFSTI CSCL 22B

After defining the reasons for and advantages of manned space stations in developing an economic program for beneficial

space exploitation, the basic Apollo Applications Program objectives and characteristics are described. The need for a high level of artificial gravity in space station design is discussed. Experimental programs for space stations can be classified under two general headings: observational experiments, which include astronomy and earth sensing, and on-board experiments, such as bioscience and biomedical research and high energy physics. Space station characteristics required to meet these experimental programs are examined, including an earth-like environment, a counter-rotating laboratory operating at essentially zero gravity, the capability of accommodating at least a 50-man crew, and both attached and station-keeping modules. Speculations concerning the future conceptual design of a relatively large space station are included. P.A.B.

N69-26483# Entwicklungsring Nord, Bremen (West Germany).
DEFINITION OF THE APOGEE STAGE FOR EUROPA 4
31 Jan. 1969 200 p refs Supported by ELDO *Its* ELDO Study 16.1
Avail: CFSTI

Supporting data for the choice between design alternatives for an upper stage of the large ELDO launcher Europa 4 are provided. The basic launcher is assumed to consist of a cluster of three Blue Streaks as a combined first and second stage and a 14-ton H_2/O_2 upper stage. The possible ascent trajectories for the missions envisaged are considered. One of the main missions will be to launch a 2-ton television satellite from French Guiana into a 24-hour orbit. ESRO

N69-26570*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF SOME SUPERSONIC DECELERATOR MODELS AT MACH NUMBERS OF 2.30 AND 4.63
Edwin E. Davenport Washington May 1969 36 p refs
(NASA-TN-D-5219) Avail: CFSTI CSCL 01A

An experimental investigation of spherically blunted 120° cones, tension shell models, and a model representative of an attached inflatable decelerator (AID) has been conducted at Mach numbers of 2.30 and 4.63 through an angle-of-attack range from about −5° to about 20°. The results show a reduction in axial force with an increase in shoulder radius for the cone models. Good agreement between theoretical and experimental values of standoff distance and bow-wave shape was obtained for the 120° cone models at Mach 4.63. The tension shell models produced a higher level of axial-force coefficients than did the cone models. After inflation the attached inflatable decelerator model produced about twice the axial-force coefficient of the cone models. Author

N69-26571# European Space Research and Technology Center, Noordwijk (Netherlands).
HEOS A-2 PROJECT DEVELOPMENT PLAN. VOLUME 1: SUMMARY
Mar. 1969 47 p
Avail: CFSTI

Plans are presented for developing and launching the HEOS A-2 satellite which will be derived from HEOS 1. The spacecraft will investigate interplanetary space and the high latitude magnetosphere and its boundary in the region around the northern neutral point. The proposed polar orbit will have an apogee height of 240,000 km and the lifetime will be at least one year. It is planned to launch the satellite from California beginning in late 1971. Details of the scientific experiments, changes to HEOS 1 subsystems, and details of the satellite structure, layout and thermal control etc. are also discussed. ESRO

N69-26572*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS 67 PROJECT. VOLUME 2: MIDCOURSE MANEUVER THROUGH END OF MISSION Final Report
1 May 1969 465 p refs
(Contract NAS7-100)
(NASA-CR-101109; JPL-TR-1203-Vol-2) Avail: CFSTI CSCL 22B

Mission planning, operations, and performance are discussed from the midcourse maneuver, which was commanded at 03:00 GMT on June 19, 1967, to the project-defined end of mission (Phase I) on December 1, 1967. The Mariner 5 spacecraft performed as planned, and data were telemetered to earth from all seven scientific experiments carried aboard the spacecraft. The telemetry system functioned in accordance with expectations, and coverage exceeded requirements. Spacecraft performance was excellent, with very few anomalies, and those of a minor nature. Recommendations for modifications affecting organization, software, etc., are included for possible use on future space missions of a similar type. For Volume 1, see N68-33060. Author

N69-26993*# Bendix Corp., Mishawaka, Ind.
STUDY OF A MODULAR EXTRAVEHICULAR ACTIVITY WORK PLATFORM
Washington NASA May 1969 67 p refs
(Contract NASw-1820)
(NASA-CR-1361; BMSD-6182) Avail: CFSTI CSCL 22B

Results of studies to establish conceptual configurations for extravehicular activity (EVA) work platforms to be used by suited astronauts in orbital operations are presented. The concept chosen consisted of a 1500 pound self-propelled EVA work platform made up of five modules which are removable and interchangeable to an extent permitting the orbital assembly of a mission oriented work platform. The scope of the study included a preliminary design of major subsystems and construction of a full scale mockup. Author

N69-27174# RAND Corp., Santa Monica, Calif.
THE JAPANESE SPACE PROGRAM: POLITICAL AND SOCIAL IMPLICATIONS
Paul F. Langer Aug. 1968 31 p refs Presented at AIAA and Am. Bar Assoc. conf. on Impact of Aerospace Sci. and Technol. on Law and Govt., Washington, D.C., 28-30 Aug. 1968
(AD-673831; P-3917) Avail: CFSTI CSCL 22/2

A review is made of Japan's space program and its relation to the nation's economy and political structure TAB

N69-27280*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS-AGENA FLIGHT PERFORMANCE FOR THE APPLICATIONS TECHNOLOGY SATELLITE ATS-2 MISSION
Washington May 1969 105 p refs
(NASA-TM-X-1800) Avail: CFSTI CSCL 22C

The Atlas–Agena launch vehicle boosted the Applications Technology Satellite ATS-2 into a transfer orbit with a perigee of 100 nautical miles (185 km) and an apogee of 6000 nautical miles (11 112 km). However, the Agena second burn did not occur, and the final circular orbit was not achieved. The Agena engine failed to restart for second burn because a propellant isolation valve malfunctioned. This report discusses the flight performance of the Atlas–Agena launch vehicle from lift-off through the Agena vehicle retromaneuver. A discussion of the propellant isolation valve failure is also included. Author

N69-27299*# General Dynamics/Convair, San Diego, Calif.
ANALYSIS AND DESIGN OF SPACE VEHICLE FLIGHT CONTROL SYSTEMS. VOLUME 16: ABORT

Arthur L. Greensite Washington NASA May 1969 209 p refs
(Contract NAS8-21383)
(NASA-CR-835; GDC-DDE-68-001) Avail: CFSTI CSCL 22C

The state of the art of abort procedures is discussed in terms of defining the problem areas and indicating the trends of current research. Abort methodology differs in each of five regions: (1) on the pad, (2) atmospheric, (3) exoatmospheric, (4) orbital, and (5) lunar. Recommended procedures are examined for each of these abort conditions. Unclassified details relating to the complete Gemini and Apollo abort systems are presented, and some of the more sophisticated rescue and recovery systems are briefly surveyed, including satellite life jackets, rafts, and boats, EGRESS (emergency global rescue escape and survival system), and the paracone system. Emphasis is placed on control system requirements for abort problems; hardware implementations are discussed in general terms where appropriate. P.A.B.

N69-27446*# Volt Information Sciences, Inc., Washington, D.C.
FINISH AFTER FINISH, SECOND FINISH ON VENUS AN OUTSTANDING EXPERIMENT NOW COMPLETED
21 May 1969 5 p Transl. into ENGLISH from Pravda (Moscow), no. 138, 18 May 1969
(Contract NAS5-12487)
(NASA-CR-101174; ST-PR-PS-10837) Avail: CFSTI CSCL 22A

A news release is presented on the Soviet Venera 6 flight achievements. A background is given of the study program of the planet Venus conducted by Russian space probes. B.P.

N69-27499*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VISUAL TARGET FOR RETROFIRE ATTITUDE CONTROL
Caldwell C. Johnson, inventor (to NASA) Issued 22 Apr. 1969 (Filed 26 Sep. 1968) 4 p Cl.244-1
(NASA-Case-XMS-12158-1; US-Patent-3,439,886; US-Patent-Appl-SN-762936) Avail: US Patent Office CSCL 22B

The method described involves the ejection of a luminous target, which may be a flare, a plurality of sequenced flares, or even a flashing light ejected generally along the axis of the thrust vector of the retrorocket motor prior to retrofire. Such a luminous target continues generally along the orbital path while the spacecraft is descending. Thus an effective visual target is provided which may be seen by the crewman notwithstanding luminosity of the retrorocket exhaust plume. The method therefore provides a simple and elementary means for manually maintaining proper attitude control during retrofire without the necessity of gyro-driven navigational instruments. NASA

N69-27515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A GENERAL INTRODUCTION TO ANTIAIRCRAFT ROCKETS
Sun Chia-Hung 11 Sep. 1968 7 p refs Transl. into ENGLISH from Hang Kung Chih Shin (Peking), no. 6, 1960 p 8–9
(AD-683280; FTD-HT-23-474-68) Avail: CFSTI CSCL 16/4

The air-defense rocket is launched from the surface of the ground or the ocean to down enemy aircraft; this is the surface-to-air guided missile. The air-defense rocket is a two-stage rocket of moderate size. The rocket engine of the first stage pushes the guided missile to a supersonic velocity, and the second-stage rocket engine maintains this flight velocity. The rocket body is slender, gradually tapering to a point at the nose. The fins of the rocket are cross-shaped or x-shaped so that high maneuverability in either one of two planes is possible. A remote-control system and automatic aiming system are used to increase the missiles accuracy. Author (TAB)

N69-27560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technolcgy Div.
PEOPLE AND SPACE
G. Pokrovskii 29 Aug. 1968 14 p Transl. into ENGLISH from Voennye Znaniya (USSR), v. 43, no. 6, 1967 p 36–37
(AD-683158; FTD-HT-23-675-68) Avail: CFSTI CSCL 22/2

A popularized discussion is given of the prospects and proposals for a manned orbiting space station. TAB

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-28181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SNAPPING THIN ELASTIC PANELS WITH RANDOM PULSE LOADS
B. P. Makarov et al 30 Jul. 1968 12 p refs Transl. into ENGLISH from Rasch. Na Parochnost. Teor. i Eksperim. Isaled. Prochnosti Mashinostr. Konstrukt. Sb. Statey (USSR), no. 11, 1965 p 378–384
(AD-683087; FTD-HT-23-379-68) Avail: CFSTI CSCL 13/13

The report discusses the problem of the stability of elastic panels under the influence of normal pulse loads of various types. In addition to the exponential pulse, the investigation of the interaction of rectangular, triangular, cosinusoidal and exponential pulses with counterpressure are given. A statistical method is used for the systems whose condition can be described by a finite number of parameters. Author (TAB)

N69-28199# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DYNAMIC STABILITY OF A NONUNIFORMLY HEATED ELASTIC ROD
G. A. Kilchinskaya 27 Sep. 1968 13 p refs Transl. into ENGLISH from Tr. Dinam. Sistem Tvard. i Zhidkikh Tel. Seminar po Dinam. Inst. (Kiev), 1965 p 49–55
(AD-683113; FTD-HT-23-671-68) Avail: CFSTI CSCL 13/13

The influence of the interconnection of temperature and force effects, periodic in time, on the stability of an elastic rod is studied. The modulus of elasticity in its relation to temperature is used to calculate the parametric effect of temperature on oscillations of the heated rod. The law of temperature field change is obtained on the basis of an exact solution of the Fourier heat equation under the following conditions: convection heat exchange between the lateral surface of the rod and the surrounding medium, and temperature change periodic in time at one end of the rod and thermal isolation at the other. A quasi-stationary heat process which does not depend on the initial thermal state of the system and is defined by a periodic function of time is studied. The variation method of Bubnov-Galerkin is used to solve the problem of heated rod oscillations. Author (TAB)

N69-28219# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
EXPANDING AXIAL WAVE ON A SUBMERGED CYLINDRICAL SHELL

Tsun C. Fang and Jerome M. Klosner Jan. 1969 77 p refs
(Contract Nonr-839(40))
(AD-683675; PIBAL-69-2) Avail: CFSTI CSCL 20/11

A double transform method is used to determine the response of a submerged, infinitely long, circular, cylindrical shell to a plane acoustic wave which acts initially at an isolated cross section, and then proceeds to propagate along the axis of the cylinder, symmetrically with respect to that cross section. The application of the Saddle Point Method to the inversion integral results in an asymptotic solution, valid for long time. Comparisons are made with the analogous steady-state solution obtained by using piston theory to describe the effects of the fluid on the shell. Author (TAB)

N69-26223*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL INVESTIGATION OF AN INFLATABLE LANDING SYSTEM HAVING OMNIDIRECTIONAL AND MULTIPLE IMPACT CAPABILITIES
John R. McGehee, Melvin E. Hathaway, and Cornelia B. Dexter Washington May 1969 58 p refs
(NASA-TN-D-5236) Avail: CFSTI CSCL 01C

The landing characteristics of a 20-compartment spherical-gas-bag landing system have been investigated for an impact normal to a smooth surface. An analysis was derived and programmed for machine computation. Calculations were made to indicate the omnidirectional, multiple-impact, and kinetic-energy-dissipating capabilities over a wide range of ambient pressures. The results of the computations are presented and show that this landing system has omnidirectional and multiple-impact capabilities. With proper design the system can dissipate 80 to 90 percent of the touchdown kinetic energy during the first impact. The computed results also indicate that this system may be designed to dissipate substantially the entire landing kinetic energy after two impacts. The ability of this landing system to perform satisfactorily over a wide range of ambient pressures has also been demonstrated through computations for landings of a selected vehicle. Author

N69-26234*# Astro Research Corp., Santa Barbara, Calif.
INVESTIGATION OF A COILABLE LATTICE COLUMN
R. F. Crawford Washington NASA May 1969 31 p ref
(Contract NAS7-427)
(NASA-CR-1301; ARC-R-310) Avail: CFSTI

A lattice column consisting of six longerons interconnected by crossed helical braces was fabricated and tested to determine the feasibility of its concept and to verify analysis of its structural performance. Its helical braces from a cross-sectional shape which can be elastically flattened. This flattened column can then be coiled longitudinally into a relatively small cylindrical volume. The test segment of the column was fabricated of 0.035 inch diameter steel wires joined together with coins into which the intersection of the wires was soldered. Tests were performed on the segment to determine its torsional stiffness, axial buckling strength, and its capability to be flattened and coiled. Author

N69-26264*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF THE CRACK PROPAGATION RATE FROM THE MEASURED DEFLECTIONS OF A SAMPLE [IZUCHENIYE SKOROSTI RASPROSTRANENIYA USTALOSTNYKH TRESHCHIN PO ZAMERAM PROGIBA OBRAZTSA]
V. V. Kruchinin et al May 1969 11 p refs Transl. into ENGLISH from Mater. 4 Soveshch. po Ustalosti Metallov (Moscow), Mar. 1966 p 107–113
(NASA-TT-F-12224) Avail: CFSTI CSCL 20K

The relation between the dimensions of a fatigue crack and the deflections of a sample is investigated experimentally. It is shown that, initially, the variation in deflections of the sample is proportional to the dimensions of a fatigue crack, and that the proportionality coefficient depends on the sample geometry, the material, and the test conditions. In the following phase, plastic steels are characterized by a different relation, while the rate of propagation of the fatigue crack decreases due to the presence of plastic strains. The existence of stresses which depend on the crack dimensions and for which a fatigue crack ceases to propagate is demonstrated. By determining the rate of propagation of fatigue cracks in standard samples, it is possible to assess the lifetime of the material in which fatigue cracks have appeared. Author

N69-26265# Technische Univ., Berlin (West Germany). Institut für Konstruktionslehre.
MINIMUM WEIGHT ANALYSIS FOR CYLINDRICAL SANDWICH SHELLS [UEBER DIE OPTIMALAUSLEGUNG VON ZYLINDRISCHEN SANDWICHSCHALEN]
E. Giencke Bad Godesberg, West Ger. Bundesmin. für Wiss. Forsch. Nov. 1968 55 p refs In GERMAN; ENGLISH summary Sponsored by ERNO Raumfahrttech. G.m.b.H., Bremen, West Ger.
(BMwF-FB-W-68-74) Avail: CFSTI

Results are presented for the estimate of the weight of axially loaded, long sandwich shells, having truss and honeycomb cores. This is performed for both the elastic and plastic range with the inclusion of the postbuckling behavior. The numerical evaluation is shown for compression loads $S_x = 10$ to 200 kp/cm and for radii of $r = 1$ to 5 m. The minimum thickness of the panels that are technically possible is particularly observed. In the range of small and medium loads the honeycomb sandwiches are superior, and it was found that truss-core sandwiches with single core are only slightly heavier in a small range than those with double core. For small loadings they are superior to them. The provision of ring stiffners does not result in any weightsaving. Author (ESRO)

N69-26284 State Univ. of New York at Buffalo.
ENERGY APPROACH IN THE DYNAMICS OF GENERALLY ORTHOTROPIC CYLINDRICAL SHELLS
Makonnen Wolde Amlak (Ph.D. Thesis) 1968 363 p
Avail: Univ. Microfilms: HC $16.45/Microfilm $4.65 Order No. 68-17306

Using the Rayleigh–Ritz method, the free and forced vibrations of general orthotropic circular cylindrical shells are investigated. Specially orthotropic and isotropic material properties are treated as special cases. Three-dimensional elasticity is employed in deriving the dynamical equations through virtual work considerations. No restriction is placed on the thickness of the shell. Thus the usual thin-shell assumptions are discarded in the general derivations. This is made possible by taking the three-dimensional displacement functions in the form of infinite power series for the longitudinal and through-thickness coordinates and trigonometric series for the circumferential coordinate. Specified boundary conditions are met using an approach proposed by Kawai. The dynamical equations are derived in terms of general curvilinear coordinates and hence are applicable to thick or thin shells of any geometry. Numerical examples are worked out for the free and forced vibration of closed circular cylindrical shells with clamped–clamped and free–clamped boundary conditions, isotropic, specially orthotropic, and generally orthotropic material properties and seven different combinations of dimensional parameters. Curves are plotted to indicate the sensitivity of "lobar" vibrations to thickness variations and the almost total insensitivity of the beam-type and torsional mode vibrations. Dissert. Abstr.

N69-26315*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
DEVELOPMENT OF IMPEDANCE SIMULATION FIXTURES FOR SPACECRAFT VIBRATION TESTS
Terry D. Scharton Washington NASA May 1969 62 p refs
(Contract NAS1-7600)
(NASA-CR-1351; BBN-1703) Avail: CFSTI CSCL 20K

An experimental program to develop vibration test fixtures which simulate the mount impedance of aerospace structures is conducted. Three fixtures designed to simulate the impedance of a launch vehicle are fabricated and evaluated in research vibration tests of a 1/2-scale mode Nimbus spacecraft. The results of the research tests indicate that impedance simulation fixtures eliminate some of the problems associated with conventional rigid fixtures at high frequencies. Guidelines for designing impedance simulation fixtures are presented. Author

N69-26319# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
THEORY OF SANDWICH SHELLS WITH LAMINATED ANISOTROPIC FACINGS. THEMIS OPTIMIZATION RESEARCH PROGRAM
R. E. Martin 7 Mar. 1969 16 p refs
(Contract N00014-68-A-0140)
(AD-683691; TR-8) Avail: CFSTI CSCL 13/13

Equations are derived which extend previous results so that the final equations are applicable to sandwich shells with laminated anisotropic facings. The facings are considered to be constructed of similar materials that obey the Kirchhoff hypothesis. Classical weak core assumptions are used for the orthotropic core. Author (TAB)

N69-26354# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
FLUTTER ANALYSIS OF TWO DIMENSIONAL CLAMPED PANELS USING POLYNOMIAL APPROXIMATION
S. Durvasula and I. Chopra Apr. 1969 34 p refs
(AE-243-S) Avail: CFSTI

The utility of polynomial approximation in the analysis of panel flutter problem is investigated. In particular, the problem of a two-dimensional clamped panel is examined in detail. For the aerodynamic loading, the two dimensional static approximation is used. The stability boundary showing the variation of critical dynamic pressure with in-plane direct stress, obtained by the modal solution is presented and compared with the available exact solution. Using these functions, the static stability boundary is also obtained. The convergence is found to be quite rapid and the agreement with the exact solution is very good indeed. The extension of the use of this polynomial approximation to rectangular clamped panels is also discussed. Author

N69-26388# National Aeronautical Establishment, Ottawa (Ontario).
FINITE PLATE-BENDING ELEMENTS IN POLAR CO-ORDINATES
Mervyn D. Olson, Garry M. Lindberg, and Helen A. Tulloch Oct. 1968 38 p refs
(AD-683911; NAE-LR-512; NRC-10575) Avail: CFSTI CSCL 13/13

Two finite elements for plate bending in polar co-ordinates are derived. One element is in the form of a circular sector and the other is in the form of an annular sector. The former element has nine degrees of freedom, while the latter has twelve, the degrees of freedom in each case being a displacement and two slopes at each element corner. The method is checked with several numerical examples. The static deflections of an annular plate and a complete circular plate, both loaded by single concentrated forces, are analyzed and the results compared with exact solutions. Calculations of the free vibrations of complete circular plates are also carried out and compared with exact solutions. Author (TAB)

N69-26454# Aeronautical Research Council (Gt. Brit.)
STATIC INSTABILITY OF RECTANGULAR ORTHOTROPIC PANELS SUBJECTED TO UNIFORM IN-PLANE LOADS AND DEFLECTION-DEPENDENT LATERAL LOADS
D. J. Johns 1969 30 p refs Supersedes ARC-29281; see N68-24134
(ARC-R/M-3569; ARC-29281) Copyright. Avail: CFSTI; HMSO 13s

Various analyses are presented for orthotropic and isotropic panels from which several elastic stability characteristics can be obtained. The loadings considered are biaxial in-plane compression and lateral loads which are dependent on the panel deflections (typically aerodynamic loadings). The panels are assumed to be resting on an elastic foundation to increase the generality of the problem. The analyses are valid for panels whose edges experience no lateral deflection but which are in general elastically restrained against rotation. The application of the analyses to particular configurations is shown and for certain isotropic panels correlation with experiment is found. Author (ESRO)

N69-26501# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
BUCKLING OF CLAMPED ISOTROPIC PARALLELOGRAMMIC PLATES
S. Durvasula Apr. 1969 36 p
(AE-245-S) Avail: CFSTI

The buckling problems of isotropic, flat, clamped parallelogrammic plates under combined loading are considered. Approximate solutions are obtained by the Galerkin method employing beam characteristic functions of a clamped-clamped beam. Numerical calculations of the buckling coefficients were made for a few side ratios and skew angles of the plate under the action of direct and shear stresses. Convergence studies were made for a few representative configurations. Results for several new plate configurations and loading conditions, as well as more accurate results for some configurations reported in previous literature, are obtained. In general, for a given side-ratio the critical values increase with the skew angle. It is felt that the use of bar buckling eigen functions for the solution of plate buckling problems should prove attractive and this aspect needs to be explored further. Author

N69-26502# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
NUMERICAL VALUES OF INTEGRALS OF BEAM CHARACTERISTIC FUNCTIONS
S. Durvasula, P. Bhatia, and P. S. Nair Mar. 1969 28 p
(AE-220-S) Avail: CFSTI

The integrals and derivatives of beam characteristic functions are presented for solving problems of vibration, stability, and equilibrium of beams, plates, etc. While the formulas for these integrals were available in the literature, the need existed for the numerical values of these integrals. An attempt is made to evaluate some of the commonly used integrals and present them in the form of tables so that they will be of help in computations. Author

N69-26614# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF SHROUDED AND UNSHROUDED PROPELLERS WITH THE AID OF FORMULAS OBTAINED FROM DIAGRAMS OF SYSTEMATIC MODEL TESTS OF PROPELLERS
V. A. Lesyukov 6 Sep. 1968 11 p refs Transl. into ENGLISH from Tr. Inst. Inzh. Vodnogo Transp. (Novosibirsk), no. 25, 1966
(AD-683119; FTD-HT-23-286-68) Avail: CFSTI CSCL 13/10

Formulas for calculating conventional propellers were obtained from diagrams of four-blade propellers of the Troost series with a disc ratio with allowance for corrections. Diagrams for four-blade propellers with symmetrical blades widened at the tips and a disc ratio of theta = 0.58 operated in shrouds were used to calculate shrouded propellers. The procedure of calculations using the obtained formulas is given. Author (TAB)

N69-26542# Purdue Univ., Lafayette, Ind. School of Aeronautics, Astronautics and Engineering Science
VISCOELASTIC TESTS UNDER FINITE STRAIN AND VARIABLE STRAIN RATE
Ronald J. Flowers and George Lianis Apr. 1969 57 p refs
(Grant NSF-GK-1969)
(AA/ES-69-5) Avail: Issuing Activity

The results of uniaxial, equal biaxial, and nonhomogeneous biaxial tension of viscoelastic materials under isothermal conditions and comparisons with predictions based on the approximate constitutive equations are presented. Theoretical expressions for uniaxial and equal biaxial constant and logarithmic stretch rates and for nonhomogeneous biaxial single-step and double-step relaxation and constant stretch rate are developed and compared with experimental results for a styrene butadiene rubber; agreement is found to be satisfactory. The uniaxial and equal biaxial constant stretch results for very short ramp times are used to predict the behavior of actual single-step relaxation tests and to study the effects of fast motion on the constitutive equations. Author

N69-26546 State Univ. of New York at Buffalo.
INELASTIC CHARACTERISTICS OF SPHERICAL SHELLS WITH AXISYMMETRIC BOUNDARIES
Nicholas P. Theophilos (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-17310

The determination of approximate elastic-plastic boundaries in a reversibly pressurized thin spherical shell with axisymmetric fixed boundaries (clamped circular edge) is considered. The technique employed makes use of the elastic stress field, in a step-wise manner, to determine, at the end of each pressure increment, approximate elastic-plastic boundaries satisfying the Tresca yield condition. The von Mises flow rule is utilized to approximately determine the state of stress in the plastic regime. The stress and deflection history is traced through the first pressurization cycle, i.e., internal pressurization, depressurization, external pressurization, and depressurization. The solution is restricted to small deformation and to cases of contained plastic deformation. The transverse shear distortion is neglected, and elastic-perfectly plastic material properties are assumed. The associated problems of incremental collapse, low cycle fatigue, and instability are also treated. Dissert. Abstr.

N69-26589*# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
THE CONFORMAL MAPPING OF THE INTERIOR OF THE UNIT CIRCLE ONTO THE INTERIOR OF A CLASS OF SMOOTH CURVES
Thomas F. Moriarty and Wil J. Worley Washington NASA May 1969 50 p refs
(Grant NGR-14-005-010)
(NASA-CR-1257) Avail: CFSTI CSCL 12A

The coefficients of the series representing the conformal mapping of the interior of the unit circle onto the interior of a class of smooth curves are tabulated for various parameters. Precise graphical comparisons of several cases have been included to graphically illustrate the nature and accuracy of the conformal mappings. A Fortran IV computer program has been listed to aid those interested in cases not included in the report. Author

N69-26582# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELASTOPLASTIC PROBLEMS OF THE THEORY OF PLATES AND SHELLS
L. M. Kachanov 4 Sep. 1968 12 p refs Transl. into ENGLISH from Tr. Vses. Konf. po Teorii Obolochek i Plastinok, 6th, Baku (USSR), 1966 p 954–959
(AD-683126; FTD-HT-23-321-68) Avail: CFSTI CSCL 13/13

The report discusses the papers presented on the elastic-plastic equilibrium of plates and shells. Author (TAB)

N69-26625 Kansas Univ., Lawrence.
AN INVESTIGATION OF PARAMETRIC STABILITY OF STIFFENED RECTANGULAR PLATES, VOLUMES 1 AND 2
Roger Carlton Duffield (Ph.D. Thesis) 1968 534 p
Avail: Univ. Microfilms: HC $24.10/Microfilm $6.80 Order No. 68-17378

The purpose of this investigation is to determine theoretically and to verify experimentally the boundaries of the regions of parametric resonance for rectangular stiffened plates subjected to periodic in-plane boundary forces. The theory developed in this investigation completely predicts the parametric response, natural frequencies and static buckling values for any simply-supported rectangular stiffened plate. Also, the theory developed for the discrete element model allows for an arbitrary choice in the size, location and number of ribs and stringers needed to stiffen a flat plate. The theory developed for the stiffened plate treated as a discrete element model correctly predicts the location of the boundaries of the regions of instability as shown by the good agreement with the experimental results. Dissert. Abstr.

N69-26632# Hydronautics Inc., Laurel, Md.
THE STEADY-STATE AND OSCILLATORY HYDRODYNAMICS OF A 20° DEADRISE PLANING SURFACE
R. Altmann Aug. 1968 90 p refs
(Contract Nonr-5153(00))
(AD-683349; TR-603-2) Avail: CFSTI CSCL 13/10

The hydrodynamic performance of a 20 deg deadrise planing surface was studied. Experiments were conducted in a high-speed, recirculating water channel. Results are compared with data of previous investigators and with the predictions of an existing planing surface theory. Agreement is very good between earlier towing tank data, the present steady-state test results, and steady-state theory. Good correspondence also exists between oscillatory test data and quasi-steady theory, but scatter in the oscillatory data prevents a rigorous verification of this theory. Author (TAB)

N69-26690# New York Univ., N.Y.
TWO LAYER ABLATION AT AN AXISYMMETRIC STAGNATION POINT
Stephen Lubard Wright-Patterson AFB, Ohio ARL Oct. 1968 46 p refs
(Contract AF 33(615)-2215)
(AD-683354; NYU-AA-67-114; ARL-68-0181) Avail: CFSTI CSCL 18/4

A study was made of the ablation of a melting and vaporizing substance near an axisymmetric stagnation point. The two region boundary layer is considered with reasonably accurate descriptions of viscosity and conductivity together with the multi-component diffusion matrix. The equations are solved by a formal integration followed by an iteration procedure based on successive approximation. Although no solutions were obtained, data corresponding to high altitude hypersonic flight with silicon dioxide as the ablating material are included for possible future numerical work. Author (TAB)

N69-26710 Cincinnati Univ., Ohio.
USE OF THE FREQUENCY RESPONSE IN DETERMINING THE TRANSIENT RESPONSE OF COMPLEX STRUCTURES TO CONCENTRATED LOADINGS
William Robert Shapton (Ph.D. Thesis) 1968 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-15192

This dissertation presents an investigation of a method for predicting the dynamic response, surface strain in particular, of complex structures due to the application of transient excitations. The procedure developed consists of an experimental evaluation of the actual structure to determine a mathematical model of it followed by an analytical evaluation of the model's response to an arbitrary excitation. The construction of the model is based on the concept of transfer functions. Since the parameters of most complex structures are unknown, the transfer function parameters are evaluated from the structure's experimentally determined frequency response. Methods for obtaining the desired parameters from the frequency response are discussed and appropriate equations presented for their evaluation. Dissert. Abstr.

N69-26831# Kaman Aircraft Corp., Bloomfield, Conn.
AN ANALYTICAL AND MODEL TEST RESEARCH STUDY ON THE KAMAN DYNAMIC ANTIRESONANT VIBRATION ISOLATOR (DAVI) Final Report
Robert Jones Nov. 1968 242 p refs
(Contract DA-44-177-AMC-391(T))
(AD-683595; R-690; USAAVLABS-TR-68-42) Avail: CFSTI CSCL 20/11

A parametric study was conducted on the basic unidirectional and two-dimensional DAVI Alpha to determine its isolation performance, and a general design criterion was obtained. Theoretical analyses, including damping across the series element, were done on the series-type DAVIs. A comparison was made of the series-type DAVI Beta and Gamma. Shock analyses for various types of inputs were done for the DAVI Alpha configuration. Experimental models of the unidirectional and two-dimensional DAVI Alpha and the series-type DAVI Beta and Gamma were constructed and tested to corroborate the theoretical results. Drop tests with three different inputs were done to determine the shock characteristics of the DAVI Alpha. Author (TAB)

N69-26858 Kansas Univ., Lawrence.
AN APPROXIMATE METHOD FOR THE RESPONSE OF STIFFENED PLATES TO APERIODIC EXCITATION
Robert Dale Ohmart (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-17433

The response of a beam-slab floor to aperiodic excitation by considering one bay of the floor system as an eccentrically stiffened, simply supported, rectangular plate was determined. The floor section was treated as a system of discrete elements, i.e., a plate and beams. The impulsive response of the system was obtained using the method of assumed modes and then the impulsive response was integrated over the selected excitation functions to obtain the final solution. A series of test floors was constructed to provide experimental data to verify the validity of the analysis. These floors were excited by both a mechanical impactor and a human impactor. The results of the analytical and experimental investigations showed that the assumed modes method gave excellent results for the fundamental natural frequency and provided a good approximation for the maximum displacement produced by either excitation function. A set of displacement curves was presented for various systems containing from one to five beams. Dissert. Abstr.

N69-26885# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
AN EXTENSION OF APT FOR PRODUCING INPUT DATA FOR A FOUR-AXIS FILAMENT WINDER POSTPROCESSOR
T. W. Bookhart, R. J. Easterday, A. H. Fowler, and R. V. Mickell 7 Feb. 1969 57 p
(Contract W-7405-ENG-26)
(Y-1653) Avail: CFSTI

Fortran computer routines, which compute a geodesic path on an arbitrary surface of revolution and determine the machine feed-eye positions, have been incorporated into the APT system. The output of these routines is a cutter location tape which is processed by an APT postprocessor to produce a punched tape for a four-axis numerically controlled filament winding machine. Author (NSA)

N69-26883 Cincinnati Univ., Ohio.
GENERAL METHOD FOR ANALYZING PLATE AND SHELL STRUCTURES
Leonard Beitch (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-15172

A numerical method for the structural analysis of complex plates and shells is presented. The method is based on a finite element approach where the continuum is divided into discrete parts that become the finite elements. Relationships between the deformation and stress distribution for the elements are derived in the form of influence coefficients. Using these coefficients, a set of linear algebraic equations are formed which, upon solution, give the stresses and deflections throughout the structure. The entire method is developed with consideration for its use on the digital computer. Dissert. Abstr.

N69-26891 Cornell Univ., Ithaca, N.Y.
FINITE ELEMENT ANALYSIS OF FREE VIBRATION AND STABILITY OF STRUCTURES SUBJECTED TO INITIAL STRESS
Chuh Mei (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-16186

A consistent finite element formulation using the displacement model is developed to analyze free vibrations of structures under arbitrary initial stresses. The critical buckling load of the structure also can be found from the analysis. A general procedure including the reduction technique of the system relationships, is presented giving the computer program for the matrix finite element analysis. Four numerical examples are given to demonstrate the use of the formulations. Computed natural frequencies of vibration and extrapolated buckling loads are compared with solutions obtained by other, classical, analytical techniques to illustrate the convergence and accuracy of the method. The configurations studied are beams under various axial loadings, plates subjected to in-plane bending stresses, and circular membranes having nonuniform edge forces. Dissert. Abstr.

N69-26939# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
TRANSIENT EXCITATION OF AN ELASTIC HALF-SPACE BY A POINT LOAD TRAVELING ON THE SURFACE
David C. Gakenheimer and Julius Miklowitz Jan. 1969 49 p refs
(Contract Nonr-220(67))
(AD-683340; TR-8) Avail: CFSTI CSCL 20/11

The propagation of transient waves in a homogeneous, isotropic, linearly elastic half-space excited by a traveling normal

point load is investigated. The load is suddenly applied and then it moves rectilinearly at a constant speed along the free surface. The displacements are derived for the interior of the half-space and for all load speeds. Wave front expansions are obtained from the exact solution, in addition to results pertaining to the steady-state displacement field. The limit case of zero load speed is considered, yielding new results for Lambs point load problem.
Author (TAB)

N69-26943# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANISOTROPIC PLATES
S. G. Lekhnitskii 1 Mar. 1968 416 p Transl. into ENGLISH of the book "Anizotropnyye Plastinki" Moscow, Gos. Izd., 1957 p 1–463
(AD-683218; FTD-HT-23-608-67) Avail: CFSTI CSCL 20/11

Three main topics are considered: (1) the generalized plane stressed state of anisotropic plates; (2) the bending of anisotropic plates, and (3) the stability of anisotropic plates. All problems discussed are concerned only with small elastic strains of plates. The material on the problem of transverse vibrations of anisotropic plates is collected in a special chapter. The main attention was paid to the practical side of the solutions presented; formulas and conclusions having theoretical interest only were mostly given without derivation.
Author (TAB)

N69-26982# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF A CYLINDRICAL PANEL
I. Iu. Babich 1968 4 p refs Transl. into ENGLISH from Prikl. Mekh (USSR), v. 4, no. 12, 1968 p 121–124
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The stability of an isotropic cylindrical panel under axial compression is investigated on the basis of the three-dimensional equations of elastic stability. The problem is reduced to a transcendental equation in the critical stress. An asymptotic expansion for the upper critical stress is obtained in the case of a thin-walled panel. The accuracy of the Kirchhoff–Love hypothesis is analyzed.
Author

N69-27023# Israel Inst. of Tech., Haifa. Dept. of Mechanics.
THERMOELASTICITY OF HETEROGENEOUS ORTHOTROPIC CYLINDRICAL SHELLS
Y. Stavsky and I. Smolash Dec. 1967 44 p refs Sponsored by Gerard Swope Found. and Technion Res. Funds
(TDM-67-7) Avail: CFSTI

The axisymmetric linear quasi-static thermoelastic equations for composite orthotropic cylindrical shells are solved in closed form for fixed-end boundary conditions. The case of semi-infinite shell is explicitly evaluated and various combinations of laminated shells are examined. It is shown that (1) shell heterogeneity, or the layer reversal effect for two-layer shells, may significantly affect the stress field obtained and its level; (2) the combined action of the composed layers transcends the sum of the individual properties and provides, in many cases, new performance unattainable by the constituents when acting as homogeneous shells; and (3) a cross thermoelastic effect is exhibited by the stress distribution for the considered composite shells.
Author

N69-27043*# Dynamic Science Corp., Monrovia, Calif.
THEORETICAL TRANSFER FUNCTIONS FOR THE SATURN S Final Report
Martin T. Soifer Oct. 1968 165 p refs
(Contract NAS8-21324)
(NASA-CR-98457) Avail: CFSTI CSCL 20K

Transfer functions describing the yaw-plane response of the Saturn S vehicle are developed when subjected to wind penetration during its boost phase. It is assumed that the vehicle is rigid in the longitudinal direction. Bending, propellant slosh, and rigid body motions are accounted for in the lateral direction. It is further assumed that the deformations are small, and that the yaw-plane motion is uncoupled from the pitch-plane motion. The equations of motion are obtained from the system's Lagrangian, in conjunction with a dissipation function. These equations are then combined with the control network equations, and the desired solution is obtained in the complex plane by invoking the Laplace transform. A computer program was developed, and the desired transfer functions were evaluated for four flight configurations during the boost phase. The results are presented in the form of amplitude and phase angle transfer functions; twenty-one of each, for each flight time, as functions of frequency.
Author

N69-27044*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.
AUTOMATED OPTIMUM DESIGN OF STRUCTURES UNDER DYNAMIC RESPONSE RESTRICTIONS
Mahesh P. Kapoor (Ph.D. Thesis) Jan. 1968 362 p refs
(Grant NsG-110-61)
(NASA-CR-66788; Rept-28) Avail: CFSTI CSCL 13M

A method to use dynamic technology within the structural synthesis framework is presented. The weight minimization of linear planar discrete structures consisting of straight one dimensional members is developed. The restrictions imposed upon the dynamic behavior involve limitations on dynamic displacements, stresses, and the range in which the natural frequencies of the structures are allowed to fall. The dynamic response is assumed to be linear, undamped and the result of known externally-applied forces at the joints or the support point displacements. The shock spectral approach is used with the modal superposition method to obtain a conservative estimate of the response quantities (dynamic displacements and stresses) for the multi-degree-of-freedom systems. The eigenvalue is obtained by minimizing the Rayleigh quotient employing the conjugate gradient method. This approach extends the important computer storage advantages.
Author

N69-27058*# TRW Systems, Redondo Beach, Calif.
AN ANALYTICAL BASIS FOR TIME-MODULATED RANDOM VIBRATION TESTING
T. K. Hasselman Jan. 1969 108 p refs
(Contract NAS1-8503)
(NASA-CR-66770; TRW-11282-6001-R0-00) Avail: CFSTI CSCL 20K

This report considers the time dependent rms response of a base excited single-degree-of-freedom system to time-modulated stationary random vibration. The excitation is characterized by a power spectral density function having an arbitrary bandwidth and center frequency, and by a deterministic modulating function. Closed form solutions are presented for three modulating functions: (1) the step function; (2) the rectangular function; and (3) the decaying exponential function. An approximate solution is provided for arbitrary modulating functions. A parameter study was made wherein parameters describing system damping, input to system bandwidth and frequency ratios, and modulating function were varied independently. Dimensionless response histories were computed and plotted for these cases. From this study it was concluded that the maximum transient rms response can differ significantly from what would be predicted by enveloping the transients with stationary levels and computing stationary response.
Author

N69-27065# Aeronautical Research Council (Gt. Brit.).
ON THE FLEXURE OF A CONICAL FRUSTUM SHELL
E. H. Mansfield 1969 44 p refs
Supersedes RAE-TR-67274; ARC-30212
(ARC-CP-1039; RAE-TR-67274; ARC-30212) Copyright. Avail: CFSTI; HMSO 10s 6d

Some of the problems associated with the flexure of two unequal cylindrical shells joined by a conical frustrum are considered theoretically and experimentally. Particular attention is given to the determination of the overall flexural stiffness of the conical frustum and to structural design considerations associated with the provision of a separation capability in the frustum. The results are particularly relevant to the design of multistage rockets. Author

N69-27094*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Solid Mechanics, Structures and Mechanical Design.

AN ALGORITHM FOR THE MINIMUM WEIGHT DESIGN OF THE GENERAL TRUSS

Milton J. Schrader (M.S. Thesis) Jun. 1969 136 p refs

(Grant NsG-110-61)

(NASA-CR-66789; Rept-24) Avail: CFSTI CSCL 20K

An algorithm is presented for the minimum weight design of a three dimensional, linear truss. The truss has an arbitrary number of nodes, members, and imposed load conditions. The members are assumed to be tubular and are described by the mean diameter and wall thickness. The truss is subjected to constraints on the nodal displacements, member stresses, and member sizes. The method, based on the integrated approach to synthesis and analysis, places an upper constraint on the design weight and transforms the original problem into a residual minimization subject to the original constraints plus the weight constraint. This new problem, cast into the form of an unconstrained minimization problem by using the Fiacco-McCormick technique, is solved for a series of decreasing values of the weight constraint until a near optimum design is reached. Author

N69-27123 Johns Hopkins Univ., Baltimore, Md.

THE ORIENTATION DEPENDENCE OF VIBRATIONAL MODES AND THEIR ASSOCIATED DISLOCATION DAMPING IN HEXAGONAL METALS

Edmund George Henneke, II (Ph.D. Thesis) 1968 183 p

Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-16427

The modes of elastic wave propagation for plane waves calculated for various orientations at one degree intervals in the hexagonal metals magnesium, titanium, beryllium, cadmium and zinc. The phase velocities and corresponding particle vibration directions were determined for each of the three elastic modes. The phenomenon of internal acoustical conical refraction is discussed in conjunction with its applicability to hexagonal metals. It is shown that this phenomenon can occur only in certain particular metals of this crystal class, depending on the values of the elastic constants. The orientation factors for disclocation damping of both traveling waves and standing waves are calculated. In one case it was assumed that dislocations are generated and moving in one slip system only. In a second case, dislocations are assumed to be generated and moving in all three slip systems which normally occur in the hexagonal metals at room temperature. Dissert. Abstr.

N69-27130# California Univ., Berkeley. Div. of Applied Mechanics.

ELASTIC–PLASTIC PLANE-STRAIN SOLUTIONS WITH SEPARABLE STRESS FIELDS

David B. Bogy Jan. 1969 26 p refs

(Contract N00014-67-A-0114)

(AD-683709; AM-69-2) Avail: CFSTI CSCL 20/11

It is shown that elastic-plastic plane-strain solutions in the infinitesimal (flow) theory of plasticity satisfying Tresca's yield criterion and associated flow rule with linear isotropic hardening, based on either equivalent plastic strain or total plastic work, can occur with separable stress field only in the following instances: solutions with uniaxial stress fields, as in bending, solutions with stress fields such that the entire domain changes from elastic to plastic at the same time, and solutions with stress fields for which the elastic-plastic boundary coincides with a principal shear stress trajectory. Whether or not a plasticity solution has a separable stress field can be determined a priorily by examining the corresponding elasticity solution. Author (TAB)

N69-27162# Southampton Univ. (England). Inst. of Sound and Vibration Research.

MEASUREMENT OF STRUCTURAL FREQUENCY RESPONSE BY TRANSIENT EXCITATION

R. G. White Jan. 1969 63 p refs

(ISVR-TR-12) Avail: CFSTI

The application of transient test methods in the measurement of the frequency response characteristics of structures is investigated by using a digital computer to carry out the Fourier transformation of the test data. Methods of generating suitable forcing functions with the required spectral properties are discussed and the development of a swept sine oscillator capable of extremely high sweep rates is described. The studies show that the frequency response characteristics may be obtained by transient excitation and that the accuracy of steady state methods can be preserved. Author

N69-27171# California Univ., Berkeley. Div. of Applied Mechanics.

ON "THERMO-RHEOLOGICALLY SIMPLE" SOLIDS

M. J. Crochet (Louvain Univ.) and P. M. Naghdi Jan. 1969 48 p refs

(Contracts Nonr-222(69); N00014-67-A-0114-0021)

(AD-683317; AM-69-3) Avail: CFSTI CSCL 20/11

Starting with the results for a non-isothermal finite linear theory of viscoelasticity, a systematic derivation of a linearized theory with infinitesimal deformation is presented for thermo-rheologically simple solids. A comparison of the resulting constitutive equations and the internal dissipation with those given previously is included. Author (TAB)

N69-27181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMOELASTIC STRESSES IN MULTILAYER PLATES AND BASES

Yu. A. Shevlyakov et al 1 Nov. 1968 15 p refs Transl. into ENGLISH from Gidroaeromekhanika (USSR), no. 2, 1965 p 75–83

(AD-683547; FTD-HT-23-969-68) Avail: CFSTI

The article considers the problem of the state of stress of a multilayer plate which is under conditions of plane deformation, and which consists of m layers which have different mechanical and thermophysical properties not dependent on the temperature. On the free surfaces of the first and last layer the temperature is given as a function of the coordinate x sub k (steady state process) or as a function of the coordinate and the time (unsteady state process). The state of stress of a multilayer bundle on an elastic or rigid base can be obtained by infinitely increasing the thickness of the last layer, h sub m approaches infinity. After setting the initial conditions, the authors solve mathematically the problem of funding the thermoelastic stresses due to steady state temperature fields, and then those due to unsteady state temperature fields. Author (TAB)

N69-27185# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Nuclear Radiation and Physics Section.

RADIOACTIVE TRACER TECHNIQUE FOR HONEYCOMB POROSITY TESTING

Frank R. Swanson and Anthony J. Favale May 1969 14 p
(RM-445) Avail: Issuing Activity

Experience with some operational aircraft has indicated that sealed honeycomb panels can apparently absorb appreciable amounts of ambient water. A relatively easy laboratory technique is described which consists of using a radioactive tracer gas to determine the gas-tight integrity of honeycomb composite structures. The basic technique can be combined with standard environmental cycling to predict whether particular types of honeycomb panels could absorb ambient water after specific flight conditions. The porosity of several types of noncycled honeycomb composites were investigated, and the results are discussed herein. Author

N69-27194# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
AIRCRAFT AND MISSILE STRUCTURES OPERATING AT HIGH TEMPERATURES Final Technical Status Report
Nicholas J. Hoff 30 Sep. 1968 10 p refs
(Contract AF 49(638)-1276)
(AD-683289; AFOSR-69-0368 TR) Avail: CFSTI CSCL 13/13

The report describes contributions made to the clarification of the buckling process of thin shells. One of the results was the discovery that a very slight modification of the classical boundary conditions results in a reduction in the value of the critical stress of the linear theory by a factor of about one-half. Another result of importance was that the procedure of Karman and Tsien in finding a minimal value of the post-buckling stress loads to a perfectly correct but trivial result. The maximal value of the equilibrium stress of the imperfect shell reached in testing machine loading has been calculated by Prof. Hoff by two methods. The number of buckles around the circumference were shown experimentally and theoretically to decrease as the length-to-radius ratio of the shell is increased. A tie-in between buckling in testing machine loading and buckling under thermal stresses was obtained theoretically and experimentally. Author (TAB)

N69-27255# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STRESSED STATE AND STRENGTH OF SINGLE-SHROUDED RADIAL TURBINE WHEELS
Ya. M. Gusak 8 Nov. 1968 14 p refs Transl. into ENGLISH from Energomashinostroyeniye (Moscow), no. 5, 1967 p 18–20
(AD-684015; FTD-HT-23-670-68) Avail: CFSTI CSCL 20/11

The effect of the design, configuration, number of vanes, and basic dimensional relationships of a wheel with radial vanes on its stressed state and strength are analyzed. Author (TAB)

N69-27277# California Univ., Livermore. Lawrence Radiation Lab.
THERMALLY GENERATED STRESS WAVES IN A DISPERSIVE ELASTIC ROD
C. Mark Percival and James A. Cheney (Calif. Univ., Davis) [1968] 41 p refs Presented at Soc. for Exptl. Stress Anal., Albany, N.Y. Sponsored by AEC
(SC-DC-67-2005; CONF-680544-1) Avail CFSTI

The propagation of thermally generated stress waves in a dispersive elastic rod was investigated both experimentally and analytically. In the experimental investigation, the end of a circular colored glass rod was heated very rapidly by the deposition of luminous energy from a Q-switched ruby laser. The light from the laser was directed parallel to the axis of the rod and deposited on the polished end of the rod. The depth of deposition was of the same order as the radius of the rod. The length of the energy pulse from the laser was 20 nsec. This resulted in heating at such a rate that it can be considered instantaneous when compared to the mechanical response of the material used. The resulting stress wave was measured using a thin quartz crystal in a Hopkinson pressure-bar arrangement. Love's modified wave equation was used to describe the motion. Author (NSA)

N69-27307# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METAL FATIGUE IN AN AIRCRAFT STRUCTURE
P. S. Shevelko 14 Nov. 1968 89 p refs Transl. into ENGLISH from the book "Ustalost' Metallov v Konstruktsiyakh Samoletov" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1967 p 1–110
(AD-683947; FTD-HT-23-491-68) Avail: CFSTI CSCL 11/6

This book, intended for professional readers, introduces the problem of metal fatigue in aircraft structures; describes some physical bases for fatigue processes which take place in airplane structures; and makes recommendations how to avoid formation of metal fatigue while the airplane is in service. Modern methods of detection of fatigue cracks are described. Research materials, both Soviet and foreign, were used in this study. Author (TAB)

N69-27399# Oak Ridge National Lab., Tenn.
THREE-DIMENSIONAL SCATTERED-LIGHT PHOTOELASTIC ANALYSIS OF AN AXISYMMETRIC EPOXY MODEL OF A PRESTRESSED CONCRETE REACTOR VESSEL
W. J. McAfee Feb. 1969 50 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2444) Avail: CFSTI

The results of a scattered-light photoelasticity analysis of a small axisymmetric epoxy model of a prestressed concrete reactor vessel are presented. The investigation reported is part of a broad model study program carried out at Oak Ridge National Laboratory to determine the suitability and accuracy of very small-scale mortar and epoxy models for investigating the elastic stress distributions and the cracking and ultimate failure modes of concrete vessels. The purpose of the photoelastic model study was to evaluate the suitability and accuracy of the scattered-light technique for determining the elastic stresses in small epoxy models of concrete vessels or of components of such vessels. The scattered-light method is briefly reviewed, the experimental investigation is described, and the stress distributions determined from the photoelastic analysis are presented. Author (NSA)

N69-27520# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF HEAT TREATMENT ON THE STRENGTH OF COMPRESSOR BLADES FROM TITANIUM ALLOYS
E. Ya. Korenevskii et al 5 Nov. 1968 7 p Transl. into ENGLISH from Tekhnol. i Organizatsiya Proizv. (USSR), no. 6, 1967 p 71–72
(AD-683539; FTD-HT-23-728-68) Avail: CFSTI CSCL 13/7

The fatigue, stress hardening, and residual stresses of compressor blades from BT3, BT8, and OT4-1 titanium alloys have been investigated. Final manual polishing induced residual tensile stresses in the surface layer of the blades; fatigue investigation of the blades showed that the service life was reduced by surface layer instability due to manual polishing. In order to increase the fatigue limit, the surface of BT3-alloy blades was subjected to shot peening; the fatigue limit after shot peening increased by 10-12%, the surface quality improved, and the service life was more stable. Author (TAB)

N69-27529# McDonnell-Douglas Co., Long Beach, Calif. Douglas Aircraft Div.
FORMAT 2: SECOND VERSION OF FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 2, SUPPLEMENT 1: DESCRIPTION OF DIGITAL COMPUTER PROGRAM Final Report, Jan. 1967–Jun. 1968

W. J. Lackey and R. E. Wild Wright-Patterson AFB, Ohio AFFDL Dec. 1968 81 p refs
(Contract F33615-67-C-1258)
(AD-683781; DAC-33569-Vol-2-Suppl-1; AFFDL-TR-66-207-Vol-2-Suppl-1) Avail: CFSTI CSCL 20/11

Programmer oriented documentation for a large-order eigensolution capability in FORMAT is presented. This capability provides for extraction of a specified number of eigenvalues and eigenvectors from a real matrix of order 2000 or less and was designed primarily for stability analysis of complex structures. The approach is based on the method of Eredelyi and may be classified as a variation of the power method. This capability is an optional addition to the matrix abstraction capability of FORMAT. Author (TAB)

N69-27530# McDonnell-Douglas Co., Long Beach, Calif. Douglas Aircraft Div.
FORMAT: FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 7: DESCRIPTION OF DIGITAL COMPUTER PROGRAM, PHASE 3 Final Report, Jan. 1967–Jun. 1968
R. C. Morris, J. R. Wells, and P. S. Yoon Wright-Patterson AFB, Ohio AFFDL Dec. 1968 174 p refs
(Contract F33615-67-C-1258)
(AD-683782; DAC-33569-Vol-7; AFFDL-TR-66-207-Vol-7) Avail: CFSTI CSCL 20/11

Contents: General phase III program description; Description of major submodules; Phase III error messages; and Phase III routines. TAB

N69-27580# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLIED MECHANICS (SELECTED ARTICLES)
2 May 1968 32 p refs Transl. into ENGLISH from Prikl. Mekhan. (USSR), v. 2, no. 7, 1966 p 1–21
(AD-679951; FTD-HT-23-730-67) Avail: CFSTI CSCL 11/4

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2. UNLOADING THEOREMS IN THE THEORY OF SMALL ELASTIC-PLASTIC DEFORMATIONS UNDER NONUNIFORM HEATING Y. N. Shevchenko p 13–25 refs (See N69-27582 14-32)

N69-27581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRESTRESSED ORIENTED FIBER GLASS WITH HOLLOW FIBERS
G. A. Wang Fo Fy *In its* Appl. Mech. 2 May 1968 p 1–12 refs (See N69-27580 14-32)
Avail: CFSTI

The basic relationships necessary for studying prestressed objects made of fiber glass with hollow fibers are discussed. Theoretical and experimental investigations indicated that a bonding agent is found in fiber glass in a complex stressed state, and that local ruptures are observed in the fiber glass causing a loss of carrying capacity of the construction. Under comparatively low external loads, the continuity of the material is violated, leading to a dehermetization of the construction and to a nonuniform stress of the armoring fibers. By setting up a prestressed state, the critical outer load, at which point the monolithicity of the fiber glass begins to be violated, may be increased. As an example, a prestressed state of cylindrical shells prepared by the method of separate longitudinal-transverse winding is analyzed. Author

N69-27582# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNLOADING THEOREMS IN THE THEORY OF SMALL ELASTIC-PLASTIC DEFORMATIONS UNDER NONUNIFORM HEATING
Yu. N. Shevchenko *In its* Appl. Mech. 2 May 1968 p 13–25 refs (See N69-27580 14-32)
Avail: CFSTI

Two theorems are presented which were proven for the case in which the mechanical characteristics of the given material are independent of the temperature. The first theorem enables a determination of the remaining stresses and deformations when no secondary plastic deformation takes place in the unloading process. The second allows the same determination when such deformations occur. Author

N69-27590 Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
STRESS ANALYSIS BY THE FINITE ELEMENT DISPLACEMENT METHOD
J. S. Campbell Dec. 1968 15 p refs
(RD/B/N-834) Avail: CFSTI

The general theory of stress analysis by the finite element method is described as a basis for subsequent reports on related computer programs. NSA

N69-27597# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
FINITE ELEMENTS FOR THE REPRESENTATION OF PLANE AND AXISYMMETRIC STRUCTURAL REINFORCEMENT
J. S. Campbell Dec. 1968 16 p refs
(RD/B/N-1195) Avail: CFSTI

The theory is derived for finite elements which suitably represent reinforcement in plane and axisymmetric structures. The effects of element self-weight are included in the derivation. The elements developed are used in the C.E.G.B. computer programs FEP and FEX. Author (NSA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-28160# Technische Hochschule Munchen (West Germany). Inst. fuer Technische Thermodynamik.
HEAT TRANSFER BY NORMAL CONVECTION, NUCLEATE BOILING, AND FILM BOILING FROM HORIZONTAL WIRES TO SATURATED FLUIDS [WAERMEUEBERGANG VOR ELEKTRISCH BEHEIZTEN HORIZONTALEN DRAEHTEN AN FLUESSIGKEITEN BEI SATTIGUNG UND NATUERLICHER KONVEKTION]
P. Pitschmann Dec. 1968 94 p refs In GERMAN; ENGLISH summary
(BMWF-FB-K-68-53) Avail: CFSTI

A study of heat transfer by natural convection, nucleate boiling, and film boiling from horizontal platinum wires to saturated water, at pressures lower than one atmosphere, is presented. The results are presented graphically, and a tentative interpretation is

given. A film boiling analysis is presented, which predicts film boiling heat transfer coefficients, for horizontal tubes and wires, with a satisfactory degree of accuracy. Modified correlation parameters, arising from the analysis, were used to correlate the present results as well as the measurements of other authors. Finally, transitions between the various heat transfer modes are discussed. Author

N69-26165# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FREELY CONVECTIVE HEAT TRANSFER AT LOW VALUES OF GRPR CRITERION
A. K. Rebrov 10 Oct. 1968 14 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 11, no. 6, 1966 p 703–709
(AD-683963; FTD-HT-23-920-68) Avail: CFSTI CSCL 20/13

Heat exchange is examined in bodies of various forms in unlimited volume. Experimental results are analyzed. Results of research on heat transfer using the calorimetric method and electrothermal analogy are presented. Author (TAB)

N69-26177# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF FLAME STABILITY
S. K. Aslanov 19 Jul. 1968 15 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 11, no. 4, 1966 p 472–478
(AD-683124; FTD-HT-23-472-68) Avail: CFSTI CSCL 21/2

An analysis was made of the stability of normal combustion of a premixed gas with respect to small hydrodynamic perturbations. Based on the linearized Navier-Stokes equation and a relationship derived previously by the author for the interaction of the flame zone of finite thickness and the hydrodynamic perturbation, equations were derived which indicate that viscosity has a stabilizing effect on normal combustion. This finding is in contrast to Einbinders theoretical result which predicted a destabilizing effect of viscosity. Author (TAB)

N69-26188 Carnegie-Mellon Univ., Pittsburgh, Pa.
NON-EQUILIBRIUM THERMODYNAMICS OF FLUID-FIELD SYSTEMS
Ralph Anthony Williams 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-17622

Non-equilibrium thermodynamics is applied to the study of multi-component, compressible, electrically and magnetically polarizable fluids, with chemical reactions, in the non-relativistic approximation. The expressions for momentum flow and the total stress tensor are derived. The ambiguity in the meaning of pressure is resolved, and a physically clear equilibrium thermodymanic system is defined and developed. The body force and entropy generation are derived. Onsager's relations are applied to a special case including the usual thermomagnetic and galvanomagnetic effects. The closed form analytical expression for the tensor relationship between forces and fluxes is derived valid for all orders of magnetic field. Dissert. Abstr.

N69-26236*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPULSIVE MOTION ON A FLAT PLATE PULSED WITH UNIFORM HEAT FLUX
Thomas H. Cochran and Eva T. Jun Washington May 1969 39 p refs
(NASA-TN-D-5249) Avail: CFSTI CSCL 20M

An analytical study was conducted for a semi-infinite flat plate that had fluid impulsively moved on its surface and at the same time pulsed with uniform heat flux over a prescribed length. The numerical solution, which was obtained by an implicit finite-difference method with nonuniform lattice dimensions, was compared with a solution for transient conduction in a slab and with a solution of the complete energy equation from the integral method of Karman-Pohlhausen. The solutions were confined to positions on the plate over which the flow is strictly transient and to fluids with Prandtl numbers greater than 1. Author

N69-26247*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
THERMODYNAMIC PROPERTIES OF LIQUID H_2O AND D_2O AND THEIR MIXTURES
Mark Solomon Washington May 1969 14 p refs
(120-34-02-01)
(NASA-TN-D-5223) Avail: CFSTI CSCL 20M

The liquid and gas phase equilibria $H_2O + D_2O = 2HDO$ have been reinvestigated. By combining spectroscopic and vapor pressure data, fairly good agreement is found between the experimental and calculated enthalpy for the liquid phase reaction. It is found that the value of the equilibrium constant for the liquid phase reaction is very close to the geometric mean value of 4.0. Author

N69-26290 Rutgers Univ., New Brunswick, N. J.
TRANSPORT PROPERTIES OF THE TYPE 2 SUPERCONDUCTORS NIOBIUM AND VANADIUM
Anthony Thomas Fiory (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-17767

Electrical resistance, thermal conductivity, and Hall, Ettingshausen, and Peltier effects were measured in several specimens as functions of an applied magnetic field and temperature. In the mixed state, the voltages and reversible heat currents in these specimens are associated with the motion of the vortex structure of type II superconductors, driven by the presence of an electric transport current. In a high purity niobium specimen, it was found that vortex pinning strongly influenced the measured voltages. The differential longitudinal and Hall resistivities at large transport currents were insensitive to pinning. Defined this way, both resistivities were found to be proportional to the magnetic induction in the specimen throughout the mixed state. In the moderate purity specimens, the vortices carried a large Ettingshausen heat current in their direction of motion. For the high purity niobium specimen, both the Peltier and Ettingshausen heat currents contain a significant contribution proportional to the flow of normal electric current. The phenomenological models of heat transport by isolated vortices agree with the zero magnetic field extrapolation of the data only at sufficiently low temperature. Dissert. Abstr.

N69-26366 North Carolina State Univ., Raleigh.
BOUNDARY VALUE PROBLEMS FOR WEDGES AND CONES UNDER HEAT CONDUCTION
Charles Alfred Davis (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms; HC $3.60/Microfilm $3.00 Order No. 68-17564

Mellin integral transforms and the Wiener-Hopf technique are used to obtain the temperature distribution in a semi-infinite wedge in which the temperature is specified on the boundary near the vertex and the remaining portion of the boundary is assumed to be insulated. Results are obtained in terms of infinite integrals. Several boundary value problems are considered for the semi-infinite cone. First, the temperature distribution is obtained for the problem where a constant temperature is specified for the portion of the surface of the cone near the vertex and the remaining surface is at zero temperature. Next, the problem is considered where a temperature dependent only upon the radial distance r, is specified on the boundary. This latter problem was for the half space or cone of angle $\pi/2$ and was solved using the Legendre transform of odd order. Finally, the mixed boundary value problem for the cone analogous to that of the wedge above is considered. Dissert. Abstr.

N69-26374# National Physical Lab., Teddington (England). Aerodynamics Div.

HEAT TRANSFER AND TRANSITION MEASUREMENTS AT M = 8.5 ON A DELTA MODEL AND A FLAT PLATE AT INCIDENCE

J. L. Wilson, L. Pennelegion, R. F. Cash, and M. J. Shilling 1969 34 p refs Supersedes NPL-Aero-1259; ARC-29986; see N68-34349

(ARC-R/M-3574; NPL-Aero-1259; ARC-29986) Copyright. Avail: CFSTI; HMSO 15s

The measurements were made on a 75°58' swept delta model and a 20° wedge in a shock tunnel. Local Reynolds number varied between 1.3×10^5 and 2.1×10^6. Transition was deduced from heat-transfer rate measurements and began at local Reynolds number down to 6.0×10^5 on the delta model. Comparison was made with other data. Author (ESRO)

N69-26395 Delaware Univ., Newark.

ANALYTICAL AND EXPERIMENTAL STUDY OF THE INFLUENCE OF AN UNHEATED SOLID STARTING LENGTH IN A TRANSPIRED BOUNDARY LAYER

Vedantam Murali Krishna Sastri (Ph.D. Thesis) 1968 199 p

Avail: Univ. Microfilms: HC: $9.00 Microfilm $3.00 Order No. 68-15553

The skin friction and heat transfer predictions for the laminar flow over a flat plate are reported for uniform blowing starting at a location where there is already a finite boundary layer thickness. The skin friction and heat transfer parameters are normalized with respect to their values for zero blowing, and the results are presented as functions of the blowing parameter and a dimensionless distance in the direction of flow. It was predicted from these results that in the laminar flow situation the influence of solid starting length on skin friction and heat transfer can be appreciable even at locations of the order of 10 times the unheated starting length. Heat transfer predictions are reported for the turbulent flow situation when an unheated, solid starting length is present preceding a flat porous plate through which air is blown at a uniform velocity. Dissert. Abstr.

N69-26449# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

THERMAL DIFFUSIVITY MEASUREMENTS BETWEEN 0°C AND 2000°C: APPLICATION TO URANIUM DIOXIDE [MESURE DE LA DIFFUSIVITE THERMIQUE DE 0°C A 2000°C: APPLICATION A L'OXYDE D'URANIUM]

Jean-Claude van Craeynest, Jean-Claude Weilbacher, and Robert Lallement Mar. 1969 49 p refs In FRENCH; ENGLISH summary

(CEA-R-3764) Avail: CFSTI

Two types of apparatus have been built to measure the thermal diffusivity of ceramic fuels. The first, based on Angström's method, operates between 0°C and 1000°C and satisfactory results have been obtained with it for iron, nickel and molybdenum. The other apparatus, based on Cowan's method, operates between 1000°C and 2000°C on thin slabs. The thermal conductivity of UO_2 has been measured from 0°C to 2000°C. There is a good agreement between the results and the well-known values for UO_2. Author (ESRO)

N69-26527# Societe Nationale d Etude et de Construction de Moteurs d Aviation, Paris (France).

DEVELOPMENT OF HIGH INTENSITY COMBUSTION CHAMBERS [DEVELOPPEMENT DES CHAMBRES DE COMBUSTION A HAUTE INTENSITE]

A. Quillevere *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sept. 1968 (See N69-26526 14-28) 26 p refs In FRENCH

Avail: CFSTI

The chemical kinetics of homogeneous and heterogeneous combustion are reviewed for a primary combustion zone from the viewpoint of efficiency and intensity. Experimental studies were carried out on spherical inlets; a maximum extinction charge and a nearly homogeneous combustion were attained for a given carburized mixture. Extending the results to the primary zone of a turboreactor was not successful because of the geometry of the inlet and the limiting factor of admissible charge loss. Further research was recommended to develop a turboreactor chamber of high combustion intensity. Transl. by B.P.

N69-26528# Lucas Gas Turbine Equipment, Ltd., Burnley (England). Engineering and Research Labs.

HIGH INTENSITY COMBUSTION: SOME THOUGHTS ON ITS ATTAINMENT WITHIN AIRCRAFT GAS TURBINE COMBUSTION CHAMBERS

J. Odgers *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 17 p refs (See N69-26526 14-28)

Avail: CFSTI

It is assumed that the heat release characteristics of the spherical combustor represent the maximum possible and, based upon this premise, the performance of aircraft combustors is analysed. Various suggestions are made to account for performance differences and these enable some estimate to be made of future design problems. To illustrate these, an ideal combustion chamber is compared with an existing practical combustor over a range of operating conditions, and their respective limitations and merits are discussed. Various performance correlation parameters are assessed and also the influence of flame tube configuration. Finally, the major problem areas associated with the attainment of a satisfactory flame tube life (materials, exhaust temperature distribution, wall temperatures, etc.) are mentioned. Author

N69-26529# Deutsche Versuchsanstalt Fur Luft- Und Raumfahrt, Porz (West Germany). Institut fuer Luftstrahlantriebe.

ON THE BURNING LIMITS OF FLAME-HOLDER-STABILIZED FLAMES IN SUPERSONIC FLOW

G. Winterfeld *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sept. 1968 15 p refs (See N69-26526 14-28)

Avail: CFSTI

The influence is studied of a special kind of fuel injection from the flame holder on the burning limits of flames which are stabilized by flame holders in supersonic flow. It is shown that, at the burning limits, the ratio of the length of the recirculation zone divided by the velocity at its boundary is a constant for non-premixed gases and does not depend on the kind of fuel injection from the flame holder. It is shown that the interaction of a shock wave with a flame in the wake of a flame holder can generate a second recirculation zone. When the intersection of the shock and the wake is shifted upstream towards the flame holder, the two recirculation zones behind the flame holder merge, forming one large zone of recirculating flow. In this case the burning limits of a flame are considerably enlarged due to the increased length of the resulting recirculation zone. Author

N69-26530# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Porz (West Germany). Institut fuer Luftstrahlantriebe.

MEASUREMENTS OF IGNITION DELAYS OF HYDROGEN AIR MIXTURES UNDER SIMULATED CONDITIONS OF SUPERSONIC COMBUSTION CHAMBERS

F. Schmalz Just *In* AGARD Advan. Components for Turbojet Eng., Pt. 2 Sep. 1968 16 p refs (See N69-26526 14-28)

Avail: CFSTI

In a big shock tube, ignition delay times of several H_2-air mixtures were measured behind reflected shocks. The attained

regions of pressures and temperatures ranged from 0.4 to 1.8 atm and 800 to 1400°K. Around 1000°K a strong influence of the reaction $H + O_2 + M \rightarrow HO_2 + M$ was found. Because the ignition delay near the second explosion limit depends strongly on temperature, a measurement of the temperature history behind the reflected shock was attempted. A simplified kinetic theory was evaluated. Author

N69-26815# European Space Technology Center, Noordwijk (Netherlands).
THE THERMAL MATHEMATICAL MODELLING OF SPACECRAFT AND THE EXPERIMENTAL VERIFICATION
E. W. V. Acton and N. C. Breddy Nov. 1968 31 p refs Presented at the Assoc. for the Develop. of Sci. and Environ. Tech. Conf., Paris, 13–14 Mar. 1968
(ESRO-TM-136-ESTEC) Avail: CFSTI

The analysis and laboratory testing by means of which it is determined if the thermal behaviour of a spacecraft in orbit will meet the design specifications are described. The first stage is to establish the thermal mathematical model, which represents the spacecraft as a system of isothermal nodes, and to calculate the heat exchanges between the nodes, first in orbit and then allowing for differences between conditions in orbit and in the heat balance chamber. The next stage is to test the model in a heat balance chamber and from the results to correct the main coefficients in the heat balance equation. This process is repeated until the design requirements are met. Some results obtained in tests on ESRO II are given. Finally a discussion of test philosophy and the requirements of a heat balance facility, followed by a note on chamber calibration, is reported. Author (ESRO)

N69-26862 Newark Coll. of Engineering, N. J.
BOILING HEAT TRANSFER IN THE PRESENCE OF ELECTRIC FIELDS
Ronald Francis Lovenguth (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-16973

The effects of a non-uniform, radial, D.C. electric field on the natural convection and nucleate boiling regimes in saturated pool boiling and on the peak heat flux phenomenon were determined for trichlorotrifluoroethane, carbon tetrachloride, dichloromonofluoromethane, and chloroform using as a heat transfer surface a 0.02 inch diameter platinum wire. Bubble departure diameters for the nucleate boiling region were measured by photographic means as a function of the electric field intensity at the heat transfer surface. The application of an electric field was found to have a significant effect on the natural convection mode of heat transfer and also the peak heat flux phenomenon. Three fold increases in the peak heat flux are not uncommon. The high dielectric constant fluids exhibit a greater increase in heat transfer per unit electric stress. Dissert. Abstr

N69-26869 Ohio State Univ., Columbus.
HEAT AND MASS TRANSFER TO A SUBFREEZING SURFACE IN A NON-UNIFORM ELECTRIC FIELD
Teng Hsueh Chuang (Ph.D. Thesis) 1968 232 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-15303

A vertical test plate precooled to subfreezing temperatures was exposed to the ambient air and the effects of electric fields were studied through the application of a high voltage between the grounded test plate and a corona wire. A simple theoretical model was developed for predicting the effects of electric fields upon the heat and mass transfer processes associated with frost formation. Two regions of the flow field created by the impinging electric wind are of primary importance in heat and mass transfer. In the stagnation flow, a linear relation for the local heat and mass transfer coefficients was assumed between the stagnation point and the wall jet region. In the wall jet, the analysis was based on laminar flow. An analysis was made of a simplified model of transient heat conduction in a frost layer. The position and the temperature of the progressing frost-air interface was obtained in a series expansion in powers of $\sqrt{t}$. Dissert. Abstr.

N69-26901 Polytechnic Inst. of Brooklyn, N.Y.
TRANSIENT THERMAL STRESSES AROUND A SEMI-CIRCULAR GROOVE IN A SEMI-INFINITE BODY
George William Sarney (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-16280

The transient thermal stress solution is determined for a semi-infinite elastic body with a semicircular cylindrical groove for a step change in temperature along the grooved and plane sections of the boundary. The treatment that follows is two dimensional due to nature of the temperature field. The transient thermal solution for the two dimensional body is split into the solution for a step change on the straight boundary of the body without a groove and the solution to account for the groove effect. The thermal stress consists of two parts, the first of which is obtained by the Goodier potential and satisfies the equilibrium equations in the body. In the second part, the boundary stresses developed on the surface of the groove by the first part of the solution are annulled by means of the complex variable method of Muskhelishvili, together with the use of the technique of analytic continuation of complex functions. Dissert. Abstr.

N69-26960# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF HEAT AND MASS TRANSFER IN THE REACTING BOUNDARY LAYER ON A POROUS PLATE
L. I. Tarasevich 5 Nov. 1968 20 p refs Transl. into ENGLISH from the publ. "Obshchie Teplo- i Massoobmena" Minsk, Izd. AN BSSR, 1966 p 37–47
(AD-683988; FTD-MT-24-370-68) Avail: CFSTI CSCL 20/13

Intensive heat fluxes and high temperatures in contemporary combustion chambers and heat exchangers cause damage to the structural elements. The damaged elements can enter into chemical reactions with each other or with the external environment. Although a large number of theoretical studies dealing with this subject have been published, information concerning experimental investigations is practically not available. For this reason, the investigation of heat and mass transfer in the boundary layer and in the pressure of chemical reactions has a very important practical application. The study shows that heat liberated during the chemical reaction is partially transfered to the plate and is used to evaporate the reacting liquid. The remaining heat is dissipated by the air flow. Author (TAB)

N69-26978*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
TABLES AND GRAPHS OF FUNCTIONS NECESSARY FOR SOLVING NONLINEAR HEAT TRANSFER CONSTANT AREA FIN PROBLEMS WITH EXAMPLES ON THEIR USE
A. R. Shouman and J. W. Price Washington May 1969 490 p refs
(NASA-TN-D-5173) Avail: CFSTI CSCL 20M

The two functions describing the solution to the nonlinear constant area fin one-dimensional heat transfer problem are evaluated and presented by tables and graphs. The use of the tables and graphs is demonstrated by considering several sample problems. Author

N69-26983# Institut d Aeronomie Spatiale de Belgique, Brussels.
GAS TRANSPORT COEFFICIENTS WITH APPLICATIONS TO AERONOMY [LES COEFFICIENTS DE TRANSPORT DES GAZ EN VUE D'APPLICATIONS AERONOMIQUES]
L. A. Mata 1969 58 p refs In FRENCH; ENGLISH summary *Its* Aeronomica Acta A - No. 59, 1969
Avail: CFSTI

Formulas were established for the thermal conductivity and diffusion coefficients for use in aeronomy, starting from the classical Enskog–Chapman theory concerning the properties of transport of gases, from the theoretical aspect of transport of internal energy, and from the experimental values. Thermal conductivity coefficients are given for gases and gas mixtures in the high atmosphere. Diffusion coefficients are also given for binary mixtures. Such formulas seem to be a satisfactory approximation for aeronomical problems. Author

N69-27008# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF GAS TEMPERATURE DURING THE ACCELERATION OF GAS TURBINE ENGINES ON THE THERMAL STATE OF TURBINE BLADES
A. I. Barskii 21 Feb. 1968 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 6, 1965 p 134–136
(AD-683285; FTD-HT-23-1337-67) Avail: CFSTI CSCL 21/5

The acceleration time of a turbocompressor in a twin-shaft gas-turbine engine can be reduced by raising the gas inlet temperature. However, the increase in the inlet temperature may result in compressor surge or overheating of the turbine blades. These effects of the inlet temperature were investigated analytically. The obtained results indicate that during acceleration, the gas inlet temperature has a very small effect on the temperature of the mean cross section of the blade. On the other hand, a 10% rise in the inlet temperature reduces the acceleration time by 25-35%. It is therefore concluded that, in general, the possibility of compressor surge should be the only factor limiting the maximum inlet temperature. Author (TAB)

N69-27025# Kansas Univ., Lawrence.
AN INVESTIGATION OF THE USE OF DRY ICE FOR ABLATION SIMULATION Final Report, Nov. 1967
D. L. Kohlman and R. W. Richardson Nov. 1967 46 p refs Sponsored by AEC Prepared for Sandia Corp.
(SC-CR-67-2844) Avail: CFSTI

The results of an investigation are presented to determine the feasibility of using dry ice (CO_2) to simulate ablation in wind tunnel experiments. A successful method of forming models is discussed and the data from a series of preliminary tests are presented. Author

N69-27037 Tulane Univ., New Orleans, La.
A METHOD FOR MEASURING THE TEMPERATURE DISTRIBUTION IN STABILIZED FLAMES
Charles Richard Rein (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-15261

Measurements of flame temperature are subject to errors caused by the heat transfer characteristics of temperature transducers. At higher temperatures the error is rarely negligible. Most often, transducer corrections have been sought by evaluation of the terms of the energy balance equation applied to the transducer, but only in special cases are the radiative and convective heat transfer characteristics known. Thus, all terms in the energy balance equation cannot be evaluated accurately. It is proposed here that the transducer error for thermocouples can be measured without data other than that taken with the thermocouples, if two thermocouples are used. The proposed method requires the evaluation of flame temperature from the first derivative of the energy balance equation with respect to wire diameter. Data were taken in a propane-air flame stabilized by an opposed air jet. A second method to take flame temperatures is also proposed. Dissert. Abstr.

N69-27121# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATIONARY TEMPERATURES DURING POROUS COOLING
M. D. Mikhailov 25 Jul. 1968 7 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 11, no. 2, 1966 p 284–288
(AD-683278; FTD-HT-23-254-68) Avail: CFSTI CSCL 20/13

The report describes the heat exchange between the coolant and the cooled body through a thick-walled porous tube or sphere. Final expressions are obtained for the equivalent coefficient of thermal conductivity of the porous body and for the relative temperature differential between the coolant and the hot body by solving the appropriate differential equations with boundary conditions. Author (TAB)

N69-27137# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODEL SCALING RULES FOR TURBOJET AND GAS TURBINE COMBUSTION CHAMBERS
Tan-Shih Chen 2 Aug. 1968 36 p refs Transl. into ENGLISH from Chi Hsien Kung Ch'eng Hsueh Pao (Peking), v. 11, no. 4, 1963 p 41–63
(AD-683222; FTD-HT-23-1483-67) Avail: CFSTI CSCL 21/2

Many rules for scaling turbojet and gas turbine combustion chambers have been developed in the past ten years, but none has been accepted as a general rule. This paper describes various methods in order to find possible scaling rules for such a combustion system. A scaling theory with respect to nonhomogeneous combustion of droplets under jet flow is suggested primarily to check various existing model scaling methods. On the basis of the suggested theory, the author finally proposes some new scaling rules and also offers conclusions for reference use in future studies. Author (TAB)

N69-27224# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PULSATION PHENOMENA DURING COMBUSTION OF NATURAL GAS IN COMBUSTION CHAMBERS OF GAS TURBINES
V. A. Khristich 11 Jul. 1968 16 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Tekhn. Konf. po Probl. Vibratsionnogo i Pulsatsionnogo Goreniya (Moscow), 1st, 1961, 1962 p 51–69
(AD-683190; FTD-MT-24-145-68) Avail: CFSTI CSCL 21/5

A qualitative study of pulsatile gas-fuel combustion in large-scale gas turbines was carried out at a gas turbine laboratory using a specially constructed experimental device. Extended tests showed that by generating a controlled flame oscillation one can: (a) avoid the disrupting effects due to accidental high amplitude oscillations; (b) intensify the favorable processes within the reaction zone; and (c) intensify (when needed) the process of convective heat transfer from the flame to the heat exchange surfaces. The tendency towards pulsed combustion within a chamber consuming natural gas increases with a decrease in the initial temperature of the air and with a decrease in pressure of the admitted gas. The article also reports the effects of different types of burners on the operation of turbines. TAB

N69-27346# Army Engineer Nuclear Cratering Group, Livermore, Calif. Lawrence Radiation Lab

PROJECT ZULU 2, PHASE 1. SINGLE-CHARGE CALIBRATION SERIES

W. W. Johnson and D. L. Nelson Nov. 1968 75 p refs
(NCG-TR-3; TR-3) Avail: CFSTI

Phase I of Project ZULU II was a laboratory-scale crater modeling experimental series consisting of the detonation of forty-two 1-pound C-4 charges in a moist compacted sand. The primary objectives were: to calibrate the medium with respect to its cratering characteristics; to determine the reproducibility of the crater dimensions; to conduct surface motion studies; and to study ejecta and fallback distribution as well as the nature of the displacements occurring in the near vicinity of the zero point and the rupture zone. The cratering curves developed from these experimental series showed an optimum depth of burst (DOB) of 1.5 feet and a rapid decrease of apparent crater dimensions until no crater resulted at a DOB greater than approximately 2.1 feet. The data for ten charges detonated at a nominal DOB of two feet resulted in a fractional standard deviation of 6.4% for crater radius and 20.6% for crater depth, the largest deviations observed for any DOB. Author (NSA)

N69-27367 Technische Hochschule Munchen (West Germany). Fakultaet Fuer Maschinenwesen und Elektrotechnik.

OPERATIONAL BEHAVIOR OF STEAM-HEATED CLUSTERS OF TUBULAR HEAT EXCHANGERS [DAS BETRIEBSVERHALTEN VON DAMPFBEHEIZTEN ROHRBUENDELWAERMEUEBERTRAGERN]

Adalbert Wiest 27 Jan. 1969 158 p refs In GERMAN
Avail: CFSTI

Mathematical models are derived and utilized for the optimal computerized simulation of two steam heated clusters of tubular head exchangers, each having a 0.33 m^2 heat transfer surface. Projected operational performance is determined by evaluating temperature increases, steam evaporation, pressure loss, heat flux, and energy potential. Obtained are heat flux values with and without clogging, heat losses with and without isolation, pressure loss, cost optimization, and construction stability parameters. Transl. by G.G.

N69-27391# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF ULTRASONIC VIBRATIONS IN THE BURNING OF CARBON

A. G. Popov 23 Aug. 1968 11 p refs Transl. into ENGLISH from Teploenerg. (Moscow), v. 8, no. 3, 1961 p 8–10
(AD-683279; FTD-HT-23-486-68) Avail: CFSTI CSCL 21/2

A description is given of an experimental set up and the results of processing experimental data on the intensification of the burning of carbon through the effect of ultrasonic vibration. Author (TAB)

N69-27394# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

EQUIPMENT FOR THE STUDY OF IN-PILE CREEP [DISPOSITIFS ETUDES DE FLUAGE EN PILE]

L. Cartier 20 Aug. 1968 14 p. In FRENCH Presented at colloq. EURATOM sur les dispositifs d'Irradiation les 10-11 Oct. 1968
(CEA-CONF-1122; P(NT)-170-113) Avail: AEC Depository Libraries

The installation is composed of a standard Chouca-type furnace with its control and feed bay and a creep cell adapted to the measurement system by resonating cavity and introduced inside the furnace. A detailed description is given of the cell and its operation. The temperature control, the tensile stress control, flux and displacement measurements are described. NSA

N69-27467# Oak Ridge National Lab., Tenn.

THERMAL FATIGUE OF ROCKET NOZZLE COOLING TUBES

D. G. Harman Feb. 1969 52 p
(Contract W-7405-eng-26)
(ORNL-TM-2089) Avail: CFSTI

Procedures were developed for testing the thermal fatigue resistance of coolant tubes in regeneratively cooled rocket nozzles of the type used in nuclear rocket engines. Specimens of Type 347 stainless steel and Hastelloy X were cycled between –200° and 1600°, 1800°, and 1900°F. Fatigue failures in the form of intergranular cracks were observed through the tube crowns after 23 to 87 thermal cycles. The number of cycles to failure depended upon the severity of the thermal cycle (temperature difference and hold time at maximum temperature) and the geometry of the test specimen. Fatigue life was decreased by increasing the maximum temperature (larger temperature difference), holding at this temperature for longer times, or denting the tube crowns before test. Fatigue life increased with decreasing tube diameter, and this observation was applied to the analysis of a typical nozzle configuration. No appreciable difference was noted between the behavior of Type 347 stainless steel and the Hastelloy X test specimens, if the ratio of tube radius to thickness was considered. Author (NSA)

N69-27489# National Aerospace Lab., Tokyo (Japan).

INVESTIGATION OF THE STREAMWISE HEAT CONDUCTION EFFECT ON THE TRANSIENT AERODYNAMIC HEATING OF THIN-SKINNED BODIES BY THE RESISTANCE NETWORK ANALOG METHOD

Koichi Ogawa 1968 21 p refs In JAPANESE; English summary
(NAL-TR-164) Avail: CFSTI

The coefficient of the aerodynamic heating in high speed flights varies for the laminar boundary layer and the turbulent boundary layer. However, the effects of the streamwise heat conduction on temperature distributions on the surface of the vehicles caused by the transient aerodynamic heating are not fully understood. It is the purpose of this paper to study and describe in detail (1) the computations of the skin temperature and distributions, considering the streamwise heat conduction; (2) the computations of the skin temperature and distributions, neglecting the streamwise heat conduction; and (3) the proposition of a resistance network analog method for solving the skin temperature and distributions in the transient aerodynamic heating of thin-skinned bodies. The resistance network analog method for solving the temperature of thin-skinned bodies are found to be very effective in obtaining the skin temperature distributions of vehicles in high speed flights. Author

N69-27547*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RE-ENTRY F TURBULENT HEAT EXPERIMENT FAMILIARIZATION MANUAL

E. W. Richardson 30 Oct. 1967 153 p refs
(Contract NAS1-6039)
(NASA-CR-66501; Doc-67SD7243) Avail: CFSTI CSCL 20M

This manual provides a familiarization for the general information on the reentry F turbulent heating experiment and spacecraft. This experiment was designed to obtain real environmental turbulent heating rate data for correlation with ground facility test results and with theoretical methods in an advanced flight regime and to determine the transition Reynolds number on a slender cone at flight conditions typical of advanced vehicles. The managerial and technical aspects of the mission are reviewed. B.F.

N69-27557# National Aerospace Lab., Tokyo (Japan).

MEASUREMENTS OF HEAT TRANSFER REDUCTION BY ABLATION AT STAGNATION REGION

Shigeaki Nomura 1968 17 p refs In JAPANESE; English summary
(NAL-TR-167) Avail: CFSTI

Heat transfer to an ablating Teflon surface was measured in a low density, high enthalpy nitrogen flow. The impact pressure was 7×10^{-3} atm and the total stream enthalpy was 900 to 4,500 cal/g. Experimental results were in good agreement with shock layer and in fairly good agreement with laminar boundary layer theory. Comparison of theories and experiments conducted in a chemically frozen flow shows that the surface of ablating Teflon is noncatalytic for the surface recombination of nitrogen atoms. From measurements of temperature distribution in the ablating Teflon, it was found that melting layer theory had to be applied rather than the usual sublimation theory. Significant findings were that density decrease and area increase of the ablating surface through thermal expansion, and surface temperature change related to the rate of ablation, cannot be neglected in ablation measurement. Author

N69-27572# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION OF EQUILIBRIUM GAS FLOWS
V. K. Molodtsov 19 Aug. 1968 13 p Transl. into ENGLISH from Sb. Chislennye Metody Resheniya Zadach Mat. i Fiz. (Moscow), 1966 p 07–213
(AD-683157; FTD-HT-23-511-68) Avail: CFSTI CSCL 20/4

A new technique for computing the thermodynamic properties of gas mixtures is described which is necessary for calculating supersonic equilibrium gas flows over bodies. It is based on differential correlations obtained from the basic equations of gas dynamics and equations of chemical equilibrium. This approach was used for calculating supersonic equilibrium gas flows past blunt bodies by the method of integral relations developed by A. A. Dorodnitsyn and O. M. Belotserkovsky. One of the advantages of this technique consists in that the obtained system of differential equations is associated with the initial approximate system of the numerical scheme for solving the gas dynamic problem and integrated together with the latter by the same method. This procedure requires less computer time than the iteration method. Supersonic flows of air over a sphere were calculated in the range of $M_\infty = 4$ to 30, $rho_\infty = 0.01$ atm, $T = 300°K$ as an illustrative example. A comparison of the results with those obtained by the iteration method shows satisfactory agreement. TAB

N69-27591# General Electric Co., Schenectady, N. Y. Research and Development Center.
HEAT TRANSFER AND HYDRAULICS: THE EFFECTS OF SUBCOOLED VOIDS Quarterly Report, Oct.-Dec. 1968
F. W. Staub, G. E. Walmet, and R. O. Niemi Dec. 1968 45 p refs Prepared for US/EURATOM
(Contract AT(30-1)-3679)
(NYO-3679; QR-7) Avail: CFSTI

Progress on an analytical and experimental program directed toward the determination of the void distribution, location of the initiation of net vapor generation, pressure drop and heat transfer coefficients in subcooled boiling water is reported. Required changes in the instrumentation and the test loop for employing Refrigerant 22 were completed. Hydrostatic pressure tests validated operation at 500 psi. Pressure, temperature and initial void calibration checks were completed. The data reduction program was converted to time sharing and debugging is complete. Data taken with reactivity and pH control agents showed lower values of mean drift velocity in the bubbly flow regime corresponding to the higher values of the distribution parameter and agreeing with the lack of bubble agglomeration observed with additives. Data for 19 test runs in the high-pressure water test loop were reduced. Inconsistencies remaining are being resolved. When the remaining runs are finished, experimental results will be compared with correlations previously developed. NSA

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-26317*# North American Aviation, Inc., Downey, Calif. Space Sciences Dept.
EXPERIMENTAL HYPERVELOCITY IMPACT RESEARCH Final Technical Report
C. N. Scully [1968] 11 p
(Contract NAS8-21007)
(NASA-CR-101104; SID-67-251) Avail: CFSTI CSCL 19G

The experimental results of a series of hypervelocity impact firings with borosilicate glass projectiles, in several size ranges from 20 to 50 microns in diameter, on both semiinfinite infinite and thin sheet targets are reported. The data allows the determination of the threshold velocity for perforation for the thin sheet targets as well as the variation of depth of penetration with velocities in the semi-infinite targets. Among the thin sheets impacted was the 0.0015' thick capacitor sensor panel of the Pegasus Satellite micrometeoroid detection system. The experiments cover the range of 18,900 feet per second to 65,000 feet per second. Author

N69-26353*# Denver Research Inst., Colo. Industrial Economics Div.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Evaluation Report, 1 Jan.-31 Mar. 1969
Dean C. Coddington, R. O. Morgan, and James E. Freeman 15 Apr. 1969 55 p refs
(Contract NSR-06-004-063)
(NASA-101142; QR-5) Avail: CFSTI CSCL 05C

The project for the analysis of technology transfer (PATT) was established to provide a better understanding of the technology transfer process by examining information on the nonspace applications made of NASA and AEC developed technology. An overview of PATT research activities during the first three months of 1969 is presented, and information incorporated into the technology transfer data bank during 1968 is reported. A preliminary attempt is made to integrate most of the information placed in the data bank since PATT's establishment in November, 1967. Five specific examples of the transfer of NASA generated technology are documented, and one recently completed special research task is summarized. Author

N69-26367*# Washington Univ., St. Louis, Mo. Dept. of Economics.
DIVERSIFICATION INTO CIVILIAN PUBLIC SECTOR MARKETS: A METHOD OF TRANSFERRING AEROSPACE TECHNOLOGY
Murray L. Weidenbaum Apr. 1969 30 p refs Working Paper No. 6902
(Contract NGR-26-008-003)
(NASA-CR-101123) Avail: CFSTI CSCL 05C

The newest and perhaps the fastest growing aspect of contracting out the performance of government activities to the private sector involves the use of the major defense and space contractors, that is, the government-oriented corporations, in the programs of domestic, welfare agencies. From the viewpoint of these companies, the civilian agencies, provide market diversification. For the agencies, these technology private companies provide capabilities not present in the government's own work force. From the viewpoint of society, the results and implications are far more subtle

and mixed; the growing involvement of industry in the government's business brings complication and concern as well as new resources. An examination in some detail should be of some value and is attempted here. Author

N69-26359*# Denver Univ., Colo. Industrial Economics Div.
TECHNOLOGY TRANSFER: A SELECTED BIBLIOGRAPHY
M. Terry Sovel 11 Nov. 1968 104 p refs
(Contract NSR-06-004-063)
(NASA-CR-101110) Avail: CFSTI CSCL 05B

This bibliography is the initial attempt at compiling a comprehensive listing on the subject of technology transfer. Technology is considered here to be technical information, including scientific knowledge, making possible the conception, development, design, production, and distribution of goods and services. Transfer here means the effective communication of such information from one person or source to a recipient who accepts it for consideration and possible application. The bibliography is further concerned with information which leads to a greater understanding of the factors affecting the transfer process, namely, the barriers and incentives to the process. The items presented represent a screening of the available literature. Material was also acquired by reviews of bibliographies on technology transfer, letters to major authors in the field, personal contacts, and monitoring of several abstracting services. It is arranged in three sections: an alphabetical listing, an author index, and a KWIC index. Author

N69-26437*# Syracuse Univ., N.Y.
SYRACUSE/NASA PROGRAM Semiannual Report, 1 Jul.-31 Dec. 1968
1 Mar. 1969 44 p refs
(Grants NGL-33-022-090; NGT-33-022-097)
(NASA-CR-101137; SAR-2) Avail: CFSTI CSCL 05A

Four major research projects, several smaller research activities, and an education and training program for graduate students are presently well under way at Syracuse University as a result of the association between the University and the National Aeronautics and Space Administration. The research and educational activity carried out under the Syracuse/NASA Program involved during this reporting period approximately twenty faculty members and fifteen graduate students associated with the research as well as those holding NASA traineeships was begun. Graduate level seminars were offered, and summer field training for several students was accomplished. University-wide seminars for faculty and students were offered and well attended. Exploration and planning of new research and educational activities were continued. Attempts were made to broaden future research activity to include faculty and students of University departments and schools previously not associated with NASA related activity. Author

N69-26647# Dominion Bureau of Ststistics, Ottawa (Ontario).
A STATISTICAL APPROACH TO RECORD LINKAGE
A. B. Sunter 1967 31 p refs Presented at Intern. Symp. on Med. Record Linkage Oxford Reg. Hosp. Board, Oxford, 16-18 Jul. 1968
(PB-179786) Avail: CFSTI CSCL 05B

The approach covers two distinct but interrelated parts of a complete theory for record linkage. The first part is concerned with the purely statistical problem of deciding whether a particular pair of records, once brought together for comparison, should be linked. The second part is concerned with the design of efficient (computer) systems to bring records together for comparison and, although this part has a significant statistical content, it will be intimately concerned with the particular computer hardware available. This paper will be concerned with the first part of the theory. Author (USGRDR)

N69-26830# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
DETERMINATION AND ANALYSIS OF SOME PARAMETERS AFFECTING THE SUBJECT INDEXING PROCESS
Richard C. Lufkin Sep. 1968 54 p refs
(Grant WSF-C472)
(AD-683688; MIT-DSR-70054; ESL-R-364) Avail: Issuing Activity CSCL 5/2

The report describes a quantitative study of subject-indexing as it is being performed by catalogers who are developing an augmented catalog as part of Project Intrex. Learning curves for the average time taken to index technical documents on a per-page basis were derived for a group of indexers. The average indexing times per page were also calculated and compared under several criteria pertaining to the nature of the documents. Author (TAB)

N69-26861# Weapons Research Establishment, Adelaide (Australia).
WEAPONS RESEARCH ESTABLISHMENT Annual Report 1967–68
1968 54 p
Avail: CFSTI

Project activities, research activities and equipment and technique developments at the Weapons Research Establishment in South Australia are reviewed. Project activities include re-entry physics research under the Sparta project, the successful firing of the first Australian satellite WRESAT, ground equipment for the Black Knight program, ELDO activities and a program for the development of a digital communication system (Mallard program) which is a joint study being undertaken in the U.S., Britain and Canada. Research activities are summarized under the headings: flight dynamics, rocket engine materials, acoustic sounding of the lower troposphere, lasers and upper atmosphere research, weapons evaluation techniques, photographic materials and processes, optical testing and investigation, gas discharge physics as well as heat conduction studies. Among equipments developed are equipment for the study of combustion reactions, telemetry systems for small projectiles, aerial measurement facilities, servocontrol systems and equipment for the Nascom network. Among the techniques developed were demultiplexing, cryogenic and foundry techniques and computer hardware. ESRO

N69-27133# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LET US HAVE SCIENTIFIC BASES FOR PLANNING
V. Arefev et al 28 Aug. 1968 6 p Transl. into ENGLISH from Izv. (Moscow), 5 Apr. 1968 p 3
(AD-683142; FTD-HT-23-600-68) Avail: CFSTI 5/1

The authors consider where the planners fit in, in the scheme of things, and why so much is written on collaboration of science and industry. They feel planning should have a place in industry and that there should be an organized long term plan which would help scientists and industry. In doing so they say research could move at a sharper pace and excel in new experiments; in this way more economy for the country could be realized. TAB

N69-27673*# National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Tex.
PILOT CURRICULUM AND INSTRUCTOR'S GUIDE EMPHASIZING SAFETY IN COMPRESSED GASES AND CRYOGENIC LIQUIDS
Edwin M. Logan and William T. Kitts 25 Aug. 1967 299 p refs
(NASA-TM-X-61563) Avail: CFSTI CSCL 13L

Emphasis in this guide is on the various safety aspects in the handling of industrial compressed gases and cryogenic liquids at the Manned Spacecraft Center, Houston. In addition, the course serves to familiarize the participant with publications, audiovisual aids, equipment, and devices in this field. Specifically, the guide covers: (1) the atmosphere and the role of quality control in compressed gases; (2) handling and related aspects of compressed gases; (3) an introduction to cryogenics and liquid oxygen; (4) related aspects on liquid nitrogen, liquid hydrogen, and liquid helium; (5) carbon dioxide and the rare gases, excluding helium; and (6) new developments. Test material and suggested lesson plans are included. K.W.

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